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CALIFORNIA SEWAGE WORKS JOURNAL

Official Publication of the California Sewage Works Association

Vol. XIV 1942 No. 2

Minutes of Fourteenth Annual Spring Conference At Bakersfield, California, April 26-28, 1942

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Sewage Works Industry in War Time

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Sewage Treatment at Army Posts

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Cannery Waste Problems

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Bakersfield Sewage Treatment Plant

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Camp Callan Sewage Treatment Plant

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Research on Sulfide Control

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Operators' Symposium

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Dairy Waste Traps

★

Sludge Heating

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CALIFORNIA SEWAGE WORKS JOURNAL

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ANNOUNCEMENTS

Fifteenth Annual Fall Convention
California Sewage Works Association
Hotel Clark, Los Angeles, Calif.
September 20-22, 1942

Sunday Evening, September 20

Registration, Dinner and Operators' Symposium.

Monday, September 21

Directors' and Operators' Breakfast. The morning session will include papers by Prof. C. G. Hyde on the San Francisco Bay Pollution Reduction, and J. L. McBride and G. L. Walters on the Orange County Sewerage System. Dehydration Plant Wastes will be discussed by Harvey Ludwig. A caravan trip is scheduled for the afternoon, including visits to the Los Angeles City Sewer Ventilating Plant and Terminal Island Plant; the Los Angeles County Sanitation Districts Treatment Plant, and the Long Beach Screening and Pumping Plants. The Annual Banquet is to be held in the evening.

Tuesday, September 22

Joint Breakfast and Technical Session with the Public Works Officers' Department, League of California Cities.

H. C. Smith will present a paper on Sewer Ventilation and Captain William T. Ingram will lead a discussion on Protection of Sewage Works in War Time. The business meeting of the afternoon will conclude the convention.

Third Annual Convention
Federation of Sewage Works Associations
Cleveland, Ohio, October 22-24, 1942

This convention will be devoted almost entirely to a discussion of war emergency measures by the leading sanitary engineers of the nation. A priorities clinic on war needed materials will be of great interest.

Arizona Sewage and Water Works Association

The fall meeting will be held in Phoenix, Arizona, at the Adams Hotel, October 16-17, 1942.

California Sewage Works Association Members in Military Service

ADAMS, Lieutenant Commander William K.—U.S.N., Washington, D. C. Formerly city engineer of Redding.

ARNOLD, Major Gerald E.—Regional sanitary engineer, U. S. Public Health Service, attached with the Office of Civilian Defense. Formerly chief water purification engineer, City of San Francisco. Member American Water Works Association; associate member American Society of Civil Engineers; chairman (1940) Sewage Plant Operators' Certification and School Committee; C.S.W.A.

BANKS, Lieutenant Harvey O.—Quartermaster Corps, Alabama. Formerly assistant hydraulic engineer, California Division of Water Resources. Graduate of Stanford University. Associate member of Society of Civil Engineers.

BANTA, Captain A. Perry—Corps of Engineers, U.S.A., Mobile, Alabama. Formerly assistant engineer, Los Angeles County Sanitation Districts at Los Angeles. Associate member American Society Civil Engineers. Graduate of Stanford University and California Institute of Technology. Part-time instructor at California Institute of Technology; chairman (1938), Sewage Plant Operators' Certification and Schools Committee; C.S.W.A.

BARDOFF, Lieutenant Julian L.—Ordnance Dept., U.S.A., Fort Sill, Okla. Formerly junior engineer, East Bay Cities Sewage Survey. Junior member American Society of Civil Engineers.

CHANLETT, Lieutenant Emil T.—Assistant Sanitary Engineer, U.S. Public Health Service, State Industrial Hygiene Service at Berkeley.

CLARK, Lieutenant John A.—C.E.C., U.S.N.R., now on Foreign duty. Formerly associate engineer for the Farm Security Administration. Associate member American Society of Civil Engineers. Graduate of Stanford University.

CORRAO, Lieutenant Joseph—U.S.N., San Francisco. Formerly superintendent of pumping plants, San Francisco, Department of Public Works. Graduate of University of California.

DeMARTINI, Major Frank E.—Sanitary Engineer, U.S. Public Health Service, Washington, D. C. Formerly with City of San Francisco and California State Bureau of Sanitary Engineers. Associate member American Society of Civil Engineers. Graduate of University of California.

DERBY, Major Ray L.—Coast Artillery, Fort Winfield Scott. Formerly assistant sanitary engineer, Bureau Water Works and Supply, City of Los Angeles; associate member American Society of Civil Engineers; member American Water Works Association; chairman (1941), Sewage Plant Operators' Certification and Schools Committee, C.S.W.A. Graduate of University of California.

DOMMES, Lieutenant Sid F.—Sanitation Corps, U.S.A., Fort Douglas, Utah. Formerly with Industrial Hygiene Department.

FOSTER, Lieutenant Herbert B.—Sanitation Corps, Camp Callan. Formerly assistant sanitary engineer, California State Bureau Sanitary Engineers. Associate member American Society of Civil Engineers. Graduate of University of California.

FOWLER, Lieutenant Commander Ray—U.S.N. Formerly city engineer, Santa Cruz.

HARRISON, Lieutenant John B.—Ordnance Department, U.S.A., San Francisco. Formerly Engineer Aide, East Bay Cities Sewage Disposal Survey.

HILTON, Captain Elton M.—U.S.A., Camp Roberts. Formerly park engineer, Yosemite National Park. Graduate of University of California.

HOMMON, Lieutenant Colonel Harry B.—Senior Sanitary Engineer, U.S. Public Health Service, San Francisco.

HOWELL, Lieutenant E. M.—U.S.A., Camp San Luis Obispo. Formerly with the Farm Security Administration.

INGRAM, Captain William T.—P.A. Sanitary Engineer (R), U.S. Public Health Service, attached with the Office of Civilian Defense, 9th Region. Formerly sanitary engineer, San Joaquin County Local Health District. Graduate of Stanford University, Master of Public Health Johns Hopkins University. Associate member American Society of Civil Engineers. Secretary-treasurer, C.S.W.A., 1940-41. Vice-chairman, Conference of Municipal Public Health Engineers for 1942.

JENNINGS, Captain J. Carl, U.S.A. Formerly Junior Engineer, Division of Water and Sewers, Sacramento. Graduate of University of California.

KELLY, Lieutenant Commander Earl M.—U.S.N., Norfolk, Va. Formerly sanitary engineer, the Dorr Company of Los Angeles. Associate member American Society of Civil Engineers. Graduate of Colorado School of Mines.

LUEBBER, Lieutenant Ralph H.—Sanitation Corps, U.S.A., Camp San Luis Obispo.

MASON, Lieutenant Commander John L.—U.S.N. Formerly City Engineer at Modesto. Associate member, American Society Civil Engineers.

MITTELSTAEDT, Brigadier General R. E., U.S.A. Formerly superintendent Division of Water and Sewers, Sacramento. Formerly with the California State National Guard as Adjutant General. Inducted into Army March, 1941, as Commander of the 79th Brigade. Has had 35 years of military experience. Served as a Major in France during World War I.

PRATT, Ensign Jack W.—U.S.N., Norfolk, Va. Formerly assistant sanitary engineer, California State Bureau of Sanitary Engineers. Graduate of University of California.

RIBAL, Major Raymond R.—Balloon Barrage Unit, U.S.A. Formerly principal assistant engineer on East Bay Cities Sewage Disposal Survey. Associate member American Society of Civil Engineers; secretary-treasurer, C.S.W.A., 1938-39. Graduate of University of California.

RIDDELL, Lieutenant A. G.—Sanitary Corps. Formerly field engineer with the Dorr Company at Los Angeles.

FOURTEENTH ANNUAL SPRING CONVENTION CALIFORNIA SEWAGE WORKS ASSOCIATION

Bakersfield, California

April 26-28, 1942

MINUTES OF THE MEETING

Sunday, April 26

President Fred D. Bowlus called the Conference to order at 8:00 P.M. in the Tower Room of the Motel Inn with 46 members present. Serious discussion was soon under way on the many experiences and problems of sewage plant operation and maintenance. Gas engine operation and cost of maintenance, sludge heating and digestion, sprinkling filters, sewer main cleaning, grease problems and control at army camps, and insect control were thoroughly discussed with almost everyone having something to say. Plans and specifications for screen chambers and requirements for connections of dairies to sanitary sewers as recently adopted by the Los Angeles County Engineer's Office were offered to the Association for its consideration by Mr. Arthur Pickett of that office. After considerable discussion Mr. Reinke suggested that this subject of dairy waste control would make a good paper for the next meeting. No action was taken at this time.

Monday April 27

Business Meeting and Papers

With 56 members present President Bowlus opened the meeting at 9:30 A.M. by introducing Mayor Alfred E. Siemon, of Bakersfield, who welcomed the members to his City and expressed their pride in Bakersfield's modern disposal plant.

Progress reports from the chairmen of the various committees were called for. Mr. Pickett of the Membership Committee reported that there were a total of 219 active members, 25 of whom had preferred the $2.50 dues whereby only alternate issues of the Sewage Works Journal are received. Plans for a membership drive are just under way. F. Wayland Jones of the Publicity Committee stated that announcements of this convention had been carried in the local paper and that the scrap book of Association Activities was up to date and ready for display. President Bowlus, reporting for the Committee to Finance the Journal, stated that the cost of our last Journal, Volume XIV, No. 1, was $356.17 and the total income from advertising was $332.50, making a deficit of only $23.67. It is expected that this deficit will be made up when the next issue is printed. Mr. Hoskinson, chairman of the Legislative Committee, reported that there had not been any sewer legislation at the special session of the State Legislature. He reviewed the recent work by the State Civilian Defense Organization and explained the functions of the Committee on Water Supply. The Secretary then reviewed the progress report mailed in by Chairman Kenneth W. Brown, of the Joint Committee on Certification of, and Schools for, Sewage Plant Operators.

Mr. Brown's committee has already contacted 65 sewage treatment plants, and 60 water plants, with a form letter giving complete information concerning certification requirements, and with a brief questionnaire requesting information as to the number of operators who would care to take a correspondence course and the type of treatment process in which they would be particularly interested. It is the plan of this committee to send the information to the operator by mail and to increase the number of places where eligible operators may take an examination for a certificate. This program is ready to go as soon as they find out how many operators wish to participate. The Secretary also read the following report mailed in by Leon B. Reynolds of the Constitution Committee:

"Two matters have been referred to this committee by Secretary Kimball with the approval of President Bowlus, as follows:

"1.—The Division of Public Health Engineering and Sanitation of the Utah Department of Health requested a corporate membership. Under our Constitution only one kind of membership is provided for and it specifically states that 'any person, or any Board, Commission or Department interested . . . may be a member.' Under this provision we already had one Department as a member and our committee was unanimous in ruling that the Utah Department could be a member and entitled to one vote.

"2.—Our By-Laws provide that we shall publish a Journal with all papers as our property subject to publication in the Journal of the Federation without impairment of the right of the Association to publish them in the California Journal. This provision is in conflict with one of the rules regarding publications of Member Associations adopted by the Board of Control of the Federation. Our Committee is unanimous in its desire to adhere to the provisions of our By-Laws."

Respectfully submitted,
LEON B. REYNOLDS, *Chairman*
C. C. KENNEDY
A. M. RAWN

A progress report of the Industrial Wastes Committee prepared by Chairman W. T. Knowlton was read by Mr. H. K. Palmer. Information on the types and quantities of industrial waste have been received from 21 cities. This data will be reported at the Fall meeting.

President Bowlus then introduced Mr. W. H. Wisely, Secretary of the Federation of Sewage Works Associations, who had flown to California from Illinois especially to attend our Conference and to give us a clear picture of the aims and activities of the Federation.

The first paper, "Treatment of Cannery Wastes," was presented by Earl M. Kelly, Sanitary Engineer for The Dorr Co., Inc. A discussion on Industrial Wastes Disposal and its effect on sewage disposal in small cities followed Mr. Kelly's paper with the following men presenting their particular problems: Mr. E. P. Hapgood, City Engineer of Anaheim; G. L. Walters, Water and Sewer Superintendent of Fullerton; and A. J. Castro, Superintendent of the Santa Clara Sewage Treatment Plant.

At 11:00 A.M. President Bowlus asked Mr. Ed. A. Reinke, Senior Sanitary Engineer, State Department of Public Health, to lead in a discussion of "Bomb Disaster Plans" and stated that all statements would be confidential and would not be recorded.

Caravan

The caravan formed immediately after the meeting and proceeded to Minter Field, where an excellent lunch was served to 50 of the members at

the cadets' mess. Immediately after lunch the members were treated to a tour around the Camp and then inspected the sewage treatment plant. The caravan proceeded to Shafter and then to Wasco, where each sewage plant was visited. The Bakersfield Plant was the last stop and considerable time was spent there to look over the many recent developments in design and in mechanical equipment. Mr. Eugene Ceriat presented a demonstration on the clarification of sewage, using chemicals and a model sized plant.

Annual Banquet

An exceptionally good banquet was enjoyed by 82 members and guests in the Fiesta Room of the Motel Inn. After dinner the group was entertained by a men's trumpet trio and by a women's vocal trio presented by the Music Department of the Bakersfield High School. Before presenting the guest speaker, President Bowlus made a few remarks and expressed his appreciation of the splendid attendance. He then introduced the various guests of honor: Mr. W. H. Wisely, Secretary of the Federation; Mr. Stunkard, Sanitary Engineer for the U. S. Engineer's office at Salt Lake City; Mrs. Carl Hoskinson; First Vice-President Carl Hoskinson; Second Vice-President Richard Pomeroy; William A. Allen, Representative to the Federation Board of Control; Mrs. Frederic Batty; and the past presidents, Frederic Batty, Edward A. Reinke, and Harold F. Gray. President Bowlus then introduced the guest speaker of the evening, Mr. Lewis H. Kessler, Chief for the Sanitary, Engineering, Water, Sewer and Service Unit, Repairs and Utilities Branch, Construction Division, Office Chief of Engineers. Mr. Kessler's address, "Sewage Treatment at Army Posts," was a comprehensive review of the problems and results in the design, maintenance and operation of sewage treatment plants constructed by the War Department under the Selective Service Act of 1940. Mr. Kessler's paper was so very interesting that he was kept busy for several hours after the banquet answering questions and discussing the subject with many members, several of whom were connected with Army camps in California.

Tuesday, April 28

Papers

With 44 members present, President Bowlus called on Mr. Uno H. Erickson, Superintendent of the Bakersfield Sewage Treatment Plant, for a brief review of his operating problems and results. Mr. T. V. Little, Engineer for the Shafter Sewage Plant, described his plant and the various current operating problems. As Mr. Eugene Ceriat was present, he was asked to explain the principle of his model sewage clarification unit demonstrated the day before at the Bakersfield Plant.

The first paper of the morning, "Sewage Works Industry in War Time," was presented by W. H. Wisely, Secretary of the Federation of Sewage Works Associations. Lieutenant Herbert B. Foster, Sanitary Corps, Camp Callan, presented a paper on the operation of the Camp Callan Sewage Treatment Plant. "Research on Sulfide Control," by Richard Pomeroy, Consulting Engineer-Chemist, was the last paper on the program.

President Bowlus adjourned the conference at 12 o'clock noon.

Respectfully submitted,

JACK H. KIMBALL, *Secretary*.

REPORT ON CHEMISTS' BREAKFAST

The Chemists' Breakfast was attended by 19 members. Dr. Pomeroy was chosen as Chairman to lead the discussions.

Charles Baugh, L. A. County Sanitation Districts, asked the members if they knew of any rapid field test other than the soap test for checking the state of generation of a sodium zeolite water softener. Consensus of opinion was that the soap test remains the most satisfactory at present.

M. Mavis introduced the subject of dissolved oxygen sampling at effluent weirs. He has experienced trouble in handling the sampling without taking a shower and thus without aerating the sampling. Discussion indicated wide acceptance of sampling immediately ahead of the weir and the use of two-bottle samplers.

Operators with many troubles at their plants expressed a desire for some system of reporting on plant operation and results to the engineer-designer. The operators feel that too often the engineers forget about plants they have designed at the time the plans leave the office. Such a system of reporting would give the engineer the benefit of knowing his errors plus the suggestions of the operator on plant layout to expedite efficient operation, both of which could be used to good advantage by the engineer on future designs. Mr. W. H. Wisely, Urbana, Illinois, stated that the State Sanitary Water Board of Illinois requires monthly operating reports from all water plants. Since many excellent suggestions are incorporated in these reports, he suggested some such method for sewage disposal plants to improve future designs. Many members questioned whether reporting to a governmental agency would effect the desired result as efficiently as reports direct to the engineering office. The group most in favor of this constructive criticism seemed to be the engineers.

J. C. Clark, Huntington Beach, proposed a movable laboratory to run periodically the chemical analyses for the small plants within certain localities. Emphasis was placed on the fact that chemical tests in the small plant follow all other routine work, including that of landscaping and gardening. More accurate and unbiased test results could be obtained by men trained in this field using better and more complete equipment and serving more than one plant.

A short discussion on the progress being made by the Committee for the Revision of Standard Methods was led by A. J. Castro, Santa Clara. Members expressed their desire for a complete study of the filter paper method for suspended solids as a possible substitute for the Gooch crucible method.

THE SEWAGE WORKS INDUSTRY IN WAR TIME

By W. H. WISELY*

The sewage works industry is passing through its first war. The industry was not of real significance during the first World War but has progressed so rapidly since that time its acceptance as an "essential public service" is now unquestioned. It is probable, however, that any experience which might have accrued in past wars would be of minor benefit in this one because of the evolution in warfare itself. War has always introduced personnel and sabotage problems but never before has it been so necessary for any civilian services in the United States to recognize the possiblity of military damage and to adapt themselves to such a highly geared program of production.

There has already been considerable reference in the technical literature to sabotage prevention and other emergency procedures; this has been valuable in acquainting us with the nature and extent of war time problems encountered in countries which have been attacked. It is most important, however, that specific programs be developed to meet prevalent local conditions and requirements and not to conform verbatim to bulletins or manuals which may have been intended to apply to widely varying circumstances. One purpose of this discussion is to emphasize the fact that a thorough and logical study of every local situation is an essential preface to the solution of the war time problems which are anticipated. Manuals of detailed procedure are helpful and sometimes essential but must always be applied with discrimination and due regard for local conditions.

Almost every day brings new and unexpected problems to sewage works officials. Huge ordnance plants, military cantonments and defense industries are suddenly announced and speedily made ready for operation. Some existing industries are engaging in the manufacture of new products and others are expanding their operations to maximum capacities, resulting in the production of industrial wastes of such character and quantity that treatment facilities are overburdened. Should this country be attacked, there is certain to be a heavy movement of population to new locations and these evacuation centers must be ready and able to maintain sanitary surroundings. Sewerage departments, sanitary districts and similar agencies must know in advance the limitations of all parts of their facilities and must be prepared to meet all contingencies as they arise.

Protection Against Sabotage and Military Damage

To black out or not to black out; to provide special guard patrols or to depend upon regular police; to bar visitors or to encourage them; to flood light or to camouflage; these and many similar decisions are now demanding serious consideration. Obviously, some of these questions will be answered in the general program and policy adopted by community civilian protection boards and committees, since they are of regional importance. Other questions of this character must be solved by the personnel most familiar with the functions involved. The superintendents of sewers and sewage treatment should make it a point to have some place in the local

*Secretary Federation of Sewage Works Associations, Urbana, Illinois.

civilian protection committee so that they may be familiar with questions of general policy and make known their particular needs and problems. Through their technical experience, they will be able to contribute as well as receive.

Every sewage collection and treatment works has certain parts which, if damaged, may seriously impair all or large parts of the service; damage to other parts would be of isolated and minor effect. A detailed analysis of the whole system should include (a) determination of the most important and most vulnerable points (b) consideration of ways in which the saboteur might cause damage (c) detailed planning of the methods by which service could be restored in case of damage, by temporary and/or permanent repairs and (d) derivation of *practical* protective measures which would insure a minimum of disruption of service and hazard to the population. Even the most remote possibilities should be given thought, although actual employment of extreme measures might be postponed to such time as the progress of the war indicated their advisability.

Discreetness should be exercised in undertaking these functions. Unnecessary publicity serves to no advantage; it has the effect of disturbing the public mind, and, possibly, in revealing information of value to an enemy.

The Office of Civilian Defense is now organizing Plant Protection Schools in coastal states. These schools are primarily intended for training in the protection of industries, but much of the material offered should be applicable to sewage works and other utilities. Scott (Sewage Works Journal, 13, 6, 1131) offers many suggestions of similar application to sewage works.

Emergency Repairs

Sewerage departments must be in a position to maintain or restore service in case of damage by saboteurs or enemy action. Here again it is necessary to visualize details of actual procedure in the emergency and to plan accordingly. Undoubtedly, proficiency in emergency repair work will come with experience although we are all hopeful, of course, that there will be no occasion for such activity. Opportunity for the exercise of ingenuity and originality will be afforded in emergency repair work and it will be the duty of those who are called upon first to perform these duties to pass on their experiences and methods to personnel in other parts of the country.

It will be advisable to make all repairs of permanent character. Should it be impossible to avoid temporary parts of the work, it should be completed in permanent fashion at the earliest opportunity. No job should be considered complete until a detailed record is made for future reference.

Participation in the community civilian defense program will be beneficial in preparing for emergency repair work. In most cases, it will be desirable to depend upon community "pools" of construction labor and materials or arrangements with local contractors for expedient attention to damaged facilities.

Personnel Problems

Training of replacements for employees gone into military service or

industrial work, reorganization of forces to handle new duties, safety measures for protecting plant employees and investigation of their trustworthiness are among the personnel problems now demanding attention.

Encouragement and provision for employees to become informed in other duties in addition to those which are assigned them for regular attention will enable personnel changes to be made with minimum loss of efficiency. This will doubtless be particularly necessary in connection with laboratory forces since there is heavy demand for trained technicians in military service and industry.

Safety measures have received considerable attention in sewage works but, despite the universal agreement on their importance, there is some tendency to neglect full compliance with safety rules and practices. Safety is not merely an interesting discussion topic for meetings—it is a tangible necessity in conserving trained personnel. New personnel must be completely informed of the hazards of their work and instructed in their individual responsibility to employ safe methods rather than dangerous short cuts.

All employees, new or veteran, must be of undoubted loyalty and patriotism to this nation. Supervising personnel must assume responsibility for detection of any disloyal inclinations among subordinates and see that such cases are given suitable disposition. Every employee should be impressed with the fact that it is his duty to be on the alert for unusual occurrences and situations and encouraged to offer suggestions relevant to the best interest of the service being rendered.

Priorities

Federal agencies delegated to conserve and control the distribution of materials and supplies demanded in connection with the war effort, have recognized the importance of sewage works industry as an essential public service. This is evidenced by priority orders which allow priority of high rank to such services in obtaining products required for operation and maintenance. It is our duty to reciprocate for this recognition by complying unselfishly with the regulations of the War Production Board.

Waste, unnecessary new construction and over-stocked stores inventories are directly in conflict with the war effort and are, therefore, unpatriotic. There is never any justification for waste, but now more than ever it is necessary for every mechanical part to be utilized to the greatest extent before being replaced. This is not intended as a recommendation of "baling wire maintenance" but is meant to encourage deferment of parts replacement as long as is possible without damage to the equipment.

It is essential that adequate inventories of repair parts and operation supplies be maintained but overstocking constitutes a definite violation of the priority privileges and may result in penalties against the industry as a whole. Reference has already been made to the desirability of participation in community "pools" of construction materials, as this usually obviates the requirement of duplicating supplies.

A minor, yet valuable, contribution to the war effort is also possible by the restoration of junked equipment, rubber hose and other vital materials to circulation.

Public Relations

Heretofore, the stimulation of public interest in sewage works has been sought mainly through the encouragement of plant visitors, promotion of extended sewerage facilities and education of the public regarding the importance of such service. N. L. Nussbaumer, Chairman of the Federation's Committee on Public Relations, has communicated to members of his Committee the suggestion that public relations activities are of definite importance in war, as well as in peace, although he feels that new factors should be emphasized. He suggests that: (a) the need for trained and competent operation supervision and (b) complete cooperation between sewage works personnel and officials concerned with civilian protection, are probably the most important points to be stressed.

Public relations are not necessarily a derivative of publicity. Reasonable and practical measures for the control of visitors will give the public the impression that their interests are being attended and will, in these times, have a much more favorable reaction than would unrestricted visiting. Participation by sewage works personnel in community civilian protection activities will also bring about a favorable public reaction. If and when emergencies do come, alertness and willingness to undertake a share in the work that is involved will be remembered.

If the people of the community are given confidence in those who are responsible for the sewerage utility, public relations is taking care of itself.

Looking to the Future

Many important technical problems are being studied by research workers connected with educational institutions and with operating sewage works and it is to be expected that much of this work must be deferred until personnel is again available and war-time problems no longer need attention. New conclusions and ideas are constantly coming to mind and should not be cast aside because time is not currently available to investigate them fully. Such data and ideas are apt to be forgotten if not recorded for reference at a future time.

The Public Works Reserve Branch of the Federal Works Agency is now engaged in assembling data on needed public works for possible guidance of our Federal Government in the formulation of a public works program which may be found necessary at the end of the war when it becomes necessary for industry to adapt itself once more to peace-time functions. Any new public works program will undoubtedly bring about a continuation of the tremendous advance in sewage works construction which was instituted during the late depression. It will behoove everyone concerned with the administration of sewage works to cooperate in the survey being made by the Public Works Reserve and this will best be done by:

1. Making a complete inventory of all existing sewage collection and treatment units, using operation records to establish the loadings, efficiencies and maximum capacities of each part.
2. Studying this inventory to determine which units are inadequate in capacity or which may be needed as additions, taking into account, insofar as possible, the conditions anticipated following the war.
3. Listing, in the order of need, each addition or extension believed necessary.

4. Preparing a chronological program of necessary expansion based on detailed cost estimates and anticipated revenue.

It will be well, however, in developing such programs, to consider the conclusion expressed by A. M. Rawn, Chairman of the Federation's Committee on Post-War Planning, in a recent letter to members of his Committee:

> "Planning for post-war construction in sewerage and sanitation should not take the form of wishful thinking, but should be the result of hard-headed analysis of well-considered problems, and it is in that attitude that I believe this Committee should approach its task."

The writer agrees fully with Mr. Rawn's opinion that future programs should be developed cautiously and points out that any future public works projects must take into consideration the enormous burden of taxation which is incident to the conduct of the war.

In war or peace time, the sewage works industry has the same objective—to provide for continuous and effective collection, treatment and disposal of sewage and industrial wastes. The industry was important before Pearl Harbor; now it is indispensable. The task was never an easy one; now it involves new difficulties and problems. Since the emergency has come, the same creative imagination, versatility and ingenuity which have characterized the rapid progress of the sewage works industry in recent years must be directed into new channels, and, if they are applied with equivalent energy, our part in the war effort will be adequately consummated.

SEWAGE TREATMENT AT ARMY POSTS

By **LEWIS H. KESSLER and JOHN T. NORGAARD***

(Synopsis of address delivered at the 14th Annual Spring Conference at Bakersfield, April 27, 1942. The complete paper, including the charts, tables and illustrations, was published in Sewage Works Journal for July, 1942, page 757.)

After the passage of the Selective Service Act of 1940 the War Department undertook, in October of that year, what is believed to be the greatest construction program ever attempted in a short time. Architect-engineers in private practice were retained for the design and supervision of the construction. For treatment of sewage the firms of Metcalf and Eddy, of Boston, and Greeley and Hansen, of Chicago, gave advice on about 50 defense projects. Their policies made available modern and economical sewage treatment plants. These engineers were guided by the following general factors: Receiving water courses, camp sites, permanence of works, speed of construction, health of troops, reasonable economy and relation of all projects to the National Defense Program. Their final report was submitted in December, 1940.

*Chief and Associate Chief, respectively, for the Sanitary Engineering, Water, Sewer and Service Unit, Repairs and Utilities Branch, Construction Division, Office, Chief of Engineers.

In March, 1941, the Repairs and Utilities Section of the Construction Division, O.Q.M.G., was organized under the able direction of Col. G. F. Lewis. Mr. Jean Vincenz, of Fresno, Calif., is chief of the Maintenance and Repairs. At each army camp the repairs and utilities work is handled by a Post Utilities Officer. On December 16, 1941, the Office of Chief Engineers took over the Construction Division. In January, 1942, at the suggestion of the R. & U. Sections, manufacturers of sewage treatment plant equipment submitted their recommendations on the design of plants. For the guidance of plant operators a loose-leaf Repairs and Utilities Manual has been in progress. Much data have been accumulated that will be available in the future.

The basic sewage flow design rate of 70 gallons per capita has generally proven too small, although a water waste survey has caused a lessening of flow to the sewers. A B.O.D. removal of 40% in the plain sedimentation plant was considered high, 30% to 35% being actually attained. B.O.D. per capita per day was estimated at 0.20 lbs., and suspended solids at 0.27 lbs. As fats and grease predominate in army menus, clogging of sewers and fittings caused difficulties. Collection and removal at the source appears to be the best solution.

It is fortunate that the water and sewers utilities position in most every post has been filled by a sanitary engineer.

Operation Problems and Results

Reports indicate trouble from grit accumulations in digestion tanks. Unique designs in primary tank effluent launders have worked well. Grease has caused considerable filter clogging. Doten tanks have not worked very satisfactorily. Several multi-stage sludge digestion tanks have been constructed at posts. Proper treatment of supernatant liquor has been a problem.

Operation data were tabulated. Two primary treatment plants showed 28% and 29% removal of B.O.D. while two standard filter plants removed 80% and 93%. High-capacity filter plants have had filter fly breeding troubles along with many other difficulties. Operating data cover wide ranges of efficiency as would be expected. Activated sludge plants have consistently been overloaded. Bearing in mind the variety and sizes of the Army Post plants, the large number of different engineers employed in the design and the fact that most have been overloaded, the general outlook for successful sewage treatment is good. Many research projects have been undertaken for the betterment of sewage treatment plant operation.

INDUSTRIAL WASTES FOR FULLERTON

By G. L. WALTERS*

The problem of industrial wastes disposal affecting the sewage disposal system of the City of Fullerton, as is usual, has been a long time in the making.

In Fullerton, cannery wastes being discharged into the sewer lines have represented a gradually increasing factor in the flow of sewage and the difficulties of maintaining the sewer system in satisfactory operating condition. Fullerton, along with three other cities and four Sanitary Districts, uses the Orange County Joint Outfall Sewer System with final disposal in the Pacific Ocean.

Fullerton's largest industrial plant is that of the Val Vita Food Products, Inc. This food products establishment, involving canning and allied operations, is the largest industry contributing waste to the Fullerton sewage flow. The principal products packed in 1941 included: 875,970 cases of tomatoes, 652,815 cases of peaches, 318,732 cases of apricots, 143,766 cases of spinach, 72,011 cases of pork and beans, 20,775 cases of hominy, 20,775 cases of new potatoes, 18,858 cases of red beans, 7,695 cases of grapefruit juice, 6,689 cases of chili and beans, 3,659 cases of orange juice, 636 cases of pea soup, 335 cases of sweet potatoes, 324 cases of dried peas and 267 cases of lima beans.

During the tomato and peach season, which usually begins in July and lasts until late in November, the cannery operates day and night, with the normal days run being 16 hours, with a maximum pack of 40 tons per hour for tomatoes and 35 tons per hour for peaches.

The total pounds B.O.D. per season, based on probable population equivalents, amounts to about 800,000 pounds. Associated with this total of B.O.D. contributed by the cannery wastes is an estimated total of 950,000 pounds of suspended solids.

During the year 1941, the total water consumption at the Val Vita Food Products establishment, based on City of Fullerton Water Department sales, was 171,519,700 gallons. The month of August was the peak month, with a consumption of 36,643,600 gallons. Wash water and cooling water amounts of 50% to 60% of the total cannery wastes reaching the sewers.

As the waste leaves the cannery it passes through a rotary fine screen located in a pit to receive the flow by gravity. The screen itself is six feet in diameter by ten feet long with #12 mesh openings. This screen, under the best operating conditions, is capable of removing approximately 20 barrels, or 1,000 gallons of screenings per day. To avoid cannery wastes solids which by-pass the screen at times from entering the sewer, the end of the screen pit which contains the discharge pipe is covered with a metal box perforated over the entire surface with 3/16″ holes. This screen is kept from clogging by brushes operated mechanically from the rotary screen, which does, however, force much crushed pulp through the holes into the sewer and is the source of odor troubles further along the line. All of the wastes leaving the

*Water and Sewer Superintendent, Fullerton, Calif.

screen pass through a 12″ sewer pipe line to the Magnolia Pumping Station where it combines with domestic sewage from West Fullerton and the flow from the sanitary districts of Buena Park and La Habra, after which it is pumped through 11,300 feet of reinforced concrete force main to a junction with gravity line of the Outfall. At times, the line leading to the Pumping Plant is overtaxed and twice this year, during spinach canning, coupled with heavy rainfall, overflowed into the street in that section of the city served by the Magnolia Pumping Plant, thus causing numerous complaints.

During the summer season of last year, a combination of circumstances, due partly to the abnormal amount of simultaneous activity in operations of the numerous industrial establishments contributing wastes to the main outfall system and partly because of high temperature conditions, created an odor nuisance in the mere transportation of the combined wastes through the sewer lines from the upper reaches of the system at Fullerton to the lower end of the main line extending to the ocean.

To overcome odor nuisance, produced by H_2S concentration, and to help stabilize the sewage in its transportation along the main outfall, odor control consisting of ferrous chloride treatment (Scott Darcy Process) is in operation at the Magnolia Pumping Plant Station. The sewage from Fullerton, after being co-mingled in a wet well pit with that of the Sanitary Districts already mentioned, is given a dosage of 3% solution of chlorinated iron, but in spite of this hydrogen sulphide at times persists at the end of the force main. However, at this point comparatively fresh sewage from the main portion of the City of Fullerton joins the outfall line and thus reduces the H_2S concentration somewhat.

As a consequence of the inadequate functioning of the sewer lines and complaints to the City and the local Health Department, from residents in that section of the city where manholes have overflowed and also along the line of the outfall, plans are now under way to remove practically all of Val Vita Cannery wastes from the sewerage system of the City of Fullerton. Since 50% or more of the water used is for washing and cooling purposes, containing no B.O.D. or solids settleable or dissolved, and as a result of last year's complaints of nuisance along most of the outfall system, pumps and pipeline have been installed to place this portion of the cannery's effluent on a 120-acre tract of land before passing through the rotary screen.

To provide for the balance of the cannery flow, the present screen is being removed from its existing location and is being installed in series with another rotary screen of the same size with a 30-mesh wire. This effluent will be pumped to the first rotary screen, then by gravity flow through the second rotary screen and then pumped through 1,200 feet of 12″ concrete pipeline against a total head of 17′ delivering 1,500 G.P.M. to the 120-acre tract of land and there spread as in broad irrigation.

It is estimated that the double screening process will remove approximately 50% of the solids, thus leaving only the finely divided and dissolved solids remaining. Chlorination is being proposed for this effluent, should equipment be available and the need apparent. The entire layout is so

arranged that the effluent can be by-passed, after leaving the screens, to the Fullerton sewerage system.

Coupled with this emergency program of eliminating Val Vita Cannery wastes from the sewers, the management has employed the services of an Engineering Company to prepare plans for further pre-treatment of their cannery wastes before discharging into the sewers or using the tract of land for final effluent disposal. The cost of all improvements, treatment and land, together with extensions thereto, is being paid by the industry.

Other canning industries using the City of Fullerton's sewers contribute no large volume of flow and no quantity of organic solids and therefore present no immediate waste problem.

TRADE WASTES AT ANAHEIM

By E. P. HAPGOOD*

Most of you are familiar with our Orange County outfall system, used by four cities and four sanitary districts under joint agreements.

We are now constructing a new plant for the treatment of this sewage. A clarifier and primary digester were placed in operation a month ago; the secondary digester will soon be completed.

Difficulties in the operation of this plant developed immediately on account of the high proportion of citrus pulp and acid, and those communities on the system which have citrus by-products plants were asked to correct their trade wastes before sending them to the outfall sewer.

Anaheim has four such plants, grab samples of whose trade wastes showed the following range in characteristics:

Settleable solids (2 hrs. in liter Imhoff cone)	50	to	250	ml.
Temperature (°F.)	67	to	130	ml.
pH	3.8	to	4.8	ml.
Acidity (ppm $CaCO_3$)	300	to	1080	ml.
Chlorine demand (ppm Cl_2)	50	to	250	ml.
Oxygen consumed (ppm O_2)	4900	to	7900	ml.
B.O.D. 5 day (ppm O_2)	2400	to	4600	ml.

It was apparent that natural means of settling out the solids and sinking the effluent would be the cheapest and most satisfactory method of preliminary treatment. Accordingly, the use of about 10 acres of sandy soil near one of our by-products plants was secured for experimental purposes. Four rectangular basins ranging in size from 25x56 feet to 60x140 feet were excavated to a depth of 2 feet with the excavated material placed in dikes around the basins, giving us a depth of 5 feet.

Pumping of industrial waste from the nearest plant into the smallest basin, having an area of 1480 square feet, was started March 20. Inter-

*City Engineer, Anaheim, Calif.

mittent pumping for a total of 130 hours over a period of 13 days placed 320,210 gallons of waste in this basin and represents a column of water 19'8" high over the area of the basin. Drying began on the 14th day; on the 17th day the water was 12" deep and the cake of settleable solids 1¾" thick; on the 25th day free water had disappeared; on the 32nd day the cake had dried sufficiently for removal from the basin, and was 1" thick.

Our next problem is to find the optimum period of detention, balancing the inflow with the rate of percolation and thickness of cake desired.

Construction of a pipe line to bring the trade wastes from the other three by-products plants, a mile and a half distant, has been authorized, and it is hoped that by the time this association has its next meeting we will have much more progress to report.

THE TREATMENT OF CANNERY WASTES AT SANTA CLARA, CALIFORNIA

By **A. J. CASTRO***

Of the wastes from the various industries(1.) contributing to our sewerage system, one of the most important for our consideration to date has been that from the Pratt-Low Cannery. The problems presented by the wastes from this industry are (a) effective treatment of these wastes, and (b) a satisfactory method of handling the increased flow, which occurs during the canning season, on our sewage farm.

The treatment of these wastes has presented a problem since the disposal plant was put into operation. The first thing attempted was a reduction in the amount of wastes by screening at the cannery. A coarse screen, similar to that employed at Palo Alto(2.) was installed. Because of the grade of the various sewers at the cannery, it was not possible to run all of the wastes through this screen. Therefore, hand cleaned racks with half inch openings were placed in these channels whose contents did not flow to the screen. The amount of material which did not reach the screen was however, a small fraction of the total flow. This practice did not prove very effective. This year the cannery has resewered their plant so that all the sewage, except sanitary sewage, cooling water, and any fruit which may be spilled at the capping machines (which for obvious reasons is guarded against) will flow to a common point where it will pass through rotating circular screens before entering our sewers. The screens are of sixteen mesh bronze wire, 6 feet in diameter and 9 feet long.

Until last year, the usual "upside down" condition existed in our sedimentation tank during the cannery season with resulting poor removal of solids and strong sour odors about the treatment plant and on the farm. Various sludge pumping schedules were tried and what proved to be successful in 1937(1.) failed in the following years. During this period the sewage farm became loaded with material that should have remained at the treatment plant. The

*Chief Plant Operator, Santa Clara, Calif.

situation was so severe that the operation of the treatment plant during this period was questionable from an economic standpoint.

It had been observed in the laboratory that samples of the cannery effluent, when placed in jars, settled nicely, leaving a clear supernatant, the sludge remaining at the bottom of the container and showing no ready tendency to rise to the surface. The sanitary sewage alone behaved in a similar fashion. However, on mixing the two, as occurs in the sewers leading to the treatment plant, the acidity of the mixture increases from hour to hour with the production of gas, so that the sludge which has settled out at the start soon rises to the surface, buoyed by the entrained gases, in practice resulting in a layer of sludge over the surface of the clarifier.

The explanation of this seems to be, that upon mixing the two sewages the organisms present find themselves in a nutritive medium and begin to thrive, with the consequent production of acids and gas. Reasoning from this it would seem that if these organisms could be killed, or in some way have their growth inhibited, or their density decreased to the point where their effect would be minimized, satisfactory settling of the sewage solids should be accomplished. Laboratory tests in 1939 indicated that this could be accomplished by chlorination and tests since have repeatedly confirmed this latter opinion. Because of the minimum of personnel, these investigations are in no way comprehensive. However, it has been found in the laboratory that by satisfying not more than 80% of the Practical Chlorine Demand of the sewage, as it enters the treatment plant, the samples so treated will behave as well as completely chlorinated samples for a period of at least 10 hours, during which the sludge remains at the bottom of the test jar and the pH remains the same, while the untreated samples show sludge rising to the surface in anywhere up to 3 hours, and a steady increase in acidity throughout the test period.

In 1941, on the basis of these tests and through the cooperation of Mr. Maynard of Pratt-Low and Mr. White of Wallace & Tiernan, a temporary manual controlled chlorinator was obtained and we proceeded to chlorinate the raw sewage before its entrance into the sedimentation tank. At this time the cannery was canning peaches and pears. Lack of a flow meter does not permit us to give the exact dosage of chlorine used; however, it was somewhere in the neighborhood of 20 parts per million. More specifically enough chlorine was added so that a slight color could be obtained when the sewage entering the clarifier was tested with o-tolodin. However, it is not meant that this dosage was always maintained in plant operation, for what appeared to be a slight color to some of the operators corresponded at times to a few 10th of a part per million. This is counterbalanced nevertheless, at least partly, for during peak flows the capacity of the chlorinator was such that for these peaks there were times when the minimum readable color could not be obtained. Throughout this chlorination period, the sedimentation tank remained free of floating sludge and odors were at a minimum. During August, 1940 (at which time the cannery was canning peaches and pears) the raw sewage averaged 313 parts per million of suspended solids and a reduction of 36.1% was obtained. This was accomplished by employing

constant manual raking of sludge from the surface of the sedimentation tank. With the application of chlorine during this same period in 1941, at which time the suspended solids were 319 parts per million, 63.9% removal was achieved. During the tomato canning period, failure to add at least enough chlorine to show a slight residual at the entrance of the sewage to the sedimentation tank, was accompanied with dire results. The effect of chlorine on operation during this period is shown by comparing the accompanying two pictures.

(A) Was taken when no chlorine was being used. Immediately after this picture was taken, the chlorinator was started and operated for 24 hours after which picture (B) was taken.

(A) No chlorine used

A flow meter and a 400 pound automatic, program-controlled chlorinator has been recently installed so that by the end of next year's cannery season our results will be more comprehensive and on a more quantitative basis.

The chlorinator has been installed at the treatment plant so that the sewage will be treated as in our 1941 experiments. Practical difficulties weighed against its installation at any point in the main sewer ahead of the treatment plant where a saving in chlorine might be gained.

It should be mentioned that the cannery has agreed to stand the expense of chlorine used at the treatment plant over and above that used when they are not in operation. This allocation of costs will be followed until a more satisfactory procedure is found.[3.]

As mentioned earlier the effluent from the disposal plant flows onto the surrounding sewage farm, and last year we found that the 70 odd acres ordinarily set aside for the disposal of the plant effluent during this season was insufficient so that it was necessary to use another 40 acres, upon about half of which crops were already growing. This increased flow over other

years plus the heavier rainfalls of the past year has led Mr. Schott, our city engineer, to devise the following method for the disposal of the plant effluent. Parallel ponds have been constructed to hold a depth of water of 1 foot, the distance between ponds being 12 feet. At right angles to the ponds and along the edge of this area is a ditch 4 feet deep and 2 feet wide. After digging, the edge of the ditch was bevelled so that later sluffing of the side walls and filling of the ditch would be minimized. Nineteen of these ponds occupy an area of 17 acres. Water which seeps through the side walls of the ponds flows into the aforementioned ditch and it along with the water that finds its way into the ditch by direct seepage thereinto then flows to the Guadalupe creek. After the plant effluent had been discharged onto an

(B) Chlorine used

area of 17 acres, containing these ponds, for a period of 20 days, the flow in the ditch was measured and found to be 0.212 MGD, which amounted to 34.2% of the water reaching the ponds. A sufficient number of tests have not as yet been made to permit any statement as to the quality of this pond effluent. However, it is clear, sparkling and the few tests taken show it to contain dissolved oxygen. "Mosquito fish" were placed in a jar of the effluent and lived therein for a week, after which time the test was stopped.

Along with these measures the Pratt-Low cannery has arranged with the City of San Jose to pump about a third of their wastes into the latter's outfall sewer, which empties into Alviso Bay. While this last step is to our advantage the benefits to San Jose are open to discussion.

It is hoped that these measures will at least remedy the situation in part for the forthcoming cannery season.

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1. Castro, Sew. Wks. Jour. Vol. IX, No. 6, 1035, (1937)
2. Kimball & May, ibid, Vol. XIII, No. 4, 731, (1941)
3. Castro, ibid., Vol. XIII, No. 4, 729, (1941)

SUTTER PACKING COMPANY WASTE AT PALO ALTO

By **H. L. MAY***

The Sutter Packing Company has spent considerable money on improvements intended to eliminate excessive solid wastes from entering the sewer. They may get it back if the vaccuator does not work. I was down there the day it worked and we are still using a rake to try to push the solids through the bar screen. I understand the Sutter Packing Company is going to try to recover sugar from pear peelings. There may be other by-products obtainable from cannery wastes and we may get rid of our problem that way. Our problems arise not only from the strength of the wastes, but also from the volume. The cannery operations overloaded our sewers last year and we don't believe it will be satisfactory with the cannery and the City until they build a separate outfall independent of our system.

SHAFTER TREATMENT PLANT OPERATION

By **T. V. LITTLE****

The biggest trouble we had was when a company moved to town and decided to put in a potato hydrator. . . . Our charge is 50c a month for a sewer service. The man who put in the hydrator contracted to take all of the cull potatoes—and that year the pro-rate came in and they had to take all the small potatoes as well as the seconds. He had about 25,000 tons put out in a field. . . . He ground the potatoes and washed them. This wash water contained starch and had so much of it that they put it into the sewers. . . . It filled our plant solid twice and spilled over through the filter bed and went out into the water lagoons. When this decomposed we started to have law-suits because of the strong odor. . . . Tadpoles developed, died, and that didn't help matters. Finally the city passed an ordinance issued against dumping potato waste into the sewer. Then the company threw tons of potatoes away out there in a field. . . . Somebody went out and found them dried up, put them through a hammer mill and made cattle feed. It was also discovered they were fine for turkey feed. . . . So the people went back to raising potatoes and now lay them out to dry, put them through a hammer mill; 3000 tons of the meal were sold last year.

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*Assistant Superintendent Water and Sewer Divisions, Palo Alto, Calif.

**Water Superintendent and Councilman, Shafter, California.

OPERATION OF BAKERSFIELD SEWAGE TREATMENT PLANT

By UNO H. ERICKSON*

The Bakersfield Sewage Plant began operation November 23, 1939, but was shut down a week later. During the rest of the year the plant was idle due to making adjustments and alterations in the machinery. Every piece of equipment had to be gone over for adjusting or alteration, when they had operated a short time, showing that only through actual work could they be put into condition which would allow for long periods of uninterrupted operation.

The starting of the digestors was the foremost task during this early period. As the plant is isolated from all gas lines serving that portion of the district, it was decided to try starting active digestion without the aid of heating until gas could be produced in the digestors. This proved to be a very slow and impractical method.

Sludge was pumped into the primary digestor until it was about one-half full. Then the sewage was by-passed for a period of several weeks. Nothing seemed to be happening in the digestor, except all the solids rose to the top in a solid blanket, until finally, after almost four months from the starting date, heat was applied to the digestor by installing a butane system in connection with the boiler and raising the temperature of the sludge from 60° F. to about 85° F.

As soon as the temperature of the sludge began increasing, the crust began to get moist and soften. By the end of two weeks, the crust was all gone and very definite signs of action in the digestor became evident, namely: foaming and very strong odors.

No seed sludge was added, as the only source of supply would have been from our old septic tank, which contained large quantities of oil, the oil having been dumped into the open tank to facilitate the burning of tules and the heavy sludge cakes which covered the surface of the tank.

After normal digestion was in progress for several weeks and the digestors were full, the water seals were filled and gas pressure was built up in the system; then the main gas valve was opened to the water heater and waste gas burners. It was soon evident that more trouble was on its way, as only sludge and water came from the burners in the boiler. This was caused, as later discovered, by a cast iron elbow, used in assembling the gas line inside the primary digestor, breaking and letting sludge into the gas lines.

Fortunately the gas meters were by-passed and the only clean-up work needed was in the water heater. All burner and pilot light orifices had to be removed, washed and blown out with air.

A new gas line from the primary digestor was installed on the outside of the tank, abandoning the original line with no attempt to repair it at this time. Later, during a period when the primary digestor gave us trouble, we

*Plant Superintendent, Bakersfield, California.

were sorry that the tank had not been drained and the piping either repaired or removed.

The laboratory work in connection with the control of operation is rather limited—in fact, laboratory work has been neglected, due to the great amount of mechanical repairs and alterations.

The principal tests performed are as follows:

1. Influent:
   (a) Total solids
   (b) Temperature and P.H.
   (c) Hydrogen sulfide content to determine ferrous chloride dosage
2. Effluent:
   (a) Total solids
3. Raw sludge:
   (a) Moisture content
   (b) % Volatile matter
4. Digested sludge:
   (a) Moisture content
   (b) % Volatile matter

No attempt has been made to keep records of the B.O.D. and removal of same. From the few B.O.D. tests taken, the reduction has been shown at about 40%. This is only a comparative figure from several samples, and the results as to B.O.D. content are not true, as the tests were not performed according to schedule in regards to incubation.

The removal of solids from the sewage throughout the plant has averaged from 60% to 70%, with the influent carrying an average of 175 p.p.m solids and the effluent an average of 60 p.p.m. These figures are taken from 8-hour composite samples, which are then averaged for the 24-hour report.

The samples of the influent are taken near the detritor outlet and the effluent samples are taken from the point of discharge from the clarifier overflow trough.

The raw sludge is about 5.5% solids, of which 68% is volatile with a pH. of 5.7. This sludge is pumped at the rate of approximately 300 gals. per hour, directly into the primary digestor, where a temperature of 85° F. to 95° F. is maintained with a pH. of 7.0 to 7.4.

Digested sludge is drawn out on an average of 32,500 gallons per week, which has an average solids content of 5% and about 50% volatile. This gives us a reduction in volatile matter of nearly 50%. On some tests the reduction goes as high as 65%, but an average reduction of 50% to 55% is considered as the plant average.

The supernatant liquor overflow from the secondary digestor gives much trouble, as it is not flexible enough to draw the liquor from any variation of levels. This often permits sludge containing from 3% to 5% solids to flow back into the primary clarifier and cause a rather acute case of gassing there, with poor results in removal of solids, most of the solids carrying over the weir and out to the farm. When this condition presents itself, our only solution is to draw sludge at the same rate as it is added to the digestors, not permitting any to return to the clarifier through the supernatant line.

Some thought has been given the idea of installing a settling tank in the

supernatant line and permit the liquor and solids to separate, with the liquor going to the clarifier and the solids back into the primary digestor.

During the winter of 1941-42, the primary digestor had a rather thorough overhauling. Late in the fall, it was discovered that the drive shaft on the mixing mechanism was broken. When the digestor was drained, the cause for this failure was discovered, going back to the broken cast iron elbow in the gas line. When the elbow had broken, it had permitted about 25 feet of four-inch pipe to slip against the lower bearing support and push the bearing out of line. This caused a strain on the shaft and finally broke it at a "weak plane" near the top of the mixer. A new shaft, lower and upper bearing had to be ordered, which came in due time.

While waiting for the repair parts for the mixer mechanism, many large cracks in the digestor dome were chipped out and patched with a mixture of sand, cement and a special compound for the prevention of shrinkage. Also additional heating coils were added, as the original coils did not transfer enough heat to the sludge. This was noticeable during cold weather, the maximum temperatures being never over 75° or 80° F. during the winter. Now it is possible to run the temperature above the 100° mark.

Upon inspection of concrete and metal in the digestor, it was found to be in good condition, with no signs of corrosion after two years of service.

The floc-clarifier was drained in May, 1941, for a routine inspection job and it was noted that all the original paint on the metal was in very poor condition, and corrosion was setting in quite badly.

Repainting was apparently the only thing to do, so plans were made for this task. The big job seemed to be in cleaning the present scale and rust off, which really turned out to be a bigger chore than was anticipated.

A sand blasting machine was rented, use of the City's air compressor was arranged for and the plant crew was transformed into a crew of sand blasters.

Painting was brought along behind the sand blasters so as not to expose any clean metal to the air any longer than 24 hours. The painting consisted of primer and two coats of Sarva Compound. All work was done by the regular plant crew, so as to keep costs down to a minimum. The plant had to be idle for nearly two months during this painting operation.

During January and February, 1942, an engine and pump were installed to utilize some of the sludge gas which had been wasted previously. A 10-inch pump was chosen, rather than a pump large enough to handle the peak loads, as the 10-inch would fit existing conditions and would handle practically the entire flow of 5 M.G.D., except during the middle of the day, when a flow rate of 6.5 M.G.D. to 8 M.G.D. occurs. This higher rate of flow occurs from 10 A.M. to 6 P.M., during which time the two variable speed electric pumps take care of the excess flows.

The gas was tested and found to have nearly 700 B.T.U. per cubic foot. Only a trace of hydrogen sulfide was detected in the gas—less than 1 grain per 100 cubic feet. From this it was decided to use the gas direct from the digestor, without installing any scrubbers to remove the hydrogen sulfide.

Bids were called for on the engine and pump complete as one unit, and the contract awarded to Pacific Enterprise Co. for furnishing the engine and

pump. The engine was delivered January 15, 1942, and installation was begun right away.

All of the work of installing the pump and engine was done by the regular plant personnel, this making available two or three men to work on the job each day. It took two months to complete the installation, as the regular chores had to be attended to in addition to this work. The discharge pipe, with the elbows, was fabricated from 10-inch steel pipe. This was done because special cast iron fittings were not available and much time would have been wasted trying to have them cast to order. In fact, much of the material used in the installation is just good "substitutes" for what should have been used. For instance, galvanized clothes line was used for float cable instead of the usual stainless steel cable; brass valves on the gas lines, instead of iron. All in all, we are very proud to have gotten an engine, pump and materials for complete installation in this day of priorities.

The engine has been in operation since March 17, and from early indications, though no figures are yet available on savings, they should be sizeable, as the gas engine pumps about 85% of the entire flow of sewage. This should show a saving of approximately two-thirds of our electrical costs.

CAMP CALLAN SEWAGE TREATMENT PLANT

By HERBERT B. FOSTER, JR.*

Before describing the Camp Callan Sewage Treatment Plant and its operation, a brief outline will be given to explain the set-up and organization under which sewage treatment plants at Military Establishments are operated.

At every fixed Military Establishment there is stationed a Utility Office under the Corps of Engineers of the Army of the United States. A commissioned officer is in charge of the Utility Office and he may have one or more commissioned officers and other military personnel to assist him depending on the needs of the establishment in question. The Utility Officer is responsible for the operation of all utilities including the sewage treatment plant. The actual operation of the utilities is performed by civilian personnel taken from the United States Civil Service list whenever possible and work under Civil Service regulations and salary schedules.

Each sewage treatment plant is classified according to type and size. Schedules of each classification outlining the necessary operating personnel for sewage treatment plants and sampling data have been prepared for use of the Utility Officer. A Sanitary Engineer is provided for most of the larger camps to assist the Utility Officer in technical problems pertaining to Sanitation.

The chemical analysis run in Army Sewage Treatment Plants includes temperature, hydrogen-ion concentration, settlable solids, suspended solids, dissolved oxygen, B.O.D., percent relative stability, percent total solids, percent volatile solids, chlorine demand, and residual chlorine. The frequency of collecting samples and the chemical analysis to be run is prescribed for each class of plant. The chemical analysis is tabulated on a daily record form. The forms cover general data on weather, sewage flow, sludge, chlorination, and other miscellaneous information.

The Medical Department is responsible for the sanitary supervision and inspection and for reporting upon and making recommendations pertaining to the operation of the sewage treatment plant. An officer in the Sanitary Corps may be assigned to assist the Medical Department in making these inspections.

At Camp Callan, there are four regular operators. There is one operator on duty at the plant 24 hours a day. Additional labor for miscellaneous jobs is supplied when necessary. The duties of the operators are to keep the plant in good working condition, to keep the equipment serviced, to collect and run chemical analysis on samples, to keep operating records and to keep the plant and surrounding grounds orderly and clean. A civilian Sanitary Engineer is not employed by the Utility Office, so part of the work of the Sanitary Officer at this camp has been to supervise the actual operation of the plant.

Camp Callan sewage is collected by gravity in two small sumps and one main sump. The sewage from the two small sumps is pumped to the main

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sump where the total flow is pumped to the sewage treatment plant. All pumps are in duplicate and all sumps include an auxiliary gasoline driven pump.

When the camp was first opened, all of the main sewage pumps discharged more than 1000 gallons per minute, even with the discharge valves throttled, instead of the specified 500 to 100 gallons per minute. With such high pump discharges, the sewage arrived at the plant for short periods at very high rates. The total flow would reach the plant in 500 minutes out of the 1440 minutes of the day. Even at peak flows, the pumps would only operate 45 minutes out of every hour.

Pump capacities were later reduced to 685 to 1000 gallons per minute which just about doubled the time the sewage arrived at the plant. The pumps are still being improved and sewage is now being pumped to the plant almost continuously. The only addition that could now be desired would be a variable flow sewage pump to eliminate the big jump in flow when a second pump comes on to take care of peak flows.

The sewage treatment plant is operated as a single stage biofiltration plant although its original design is not strictly a biofiltration plant. It includes a Palmer-Bowlus Flume, primary sedimentation with separate sludge digestion, dosing tank, trickling filter, final sedimentation, chlorine contact tank and sludge beds. Two variable speed centrifugal pumps rated at 200 to 500 G.P.M. are used for pumping sludge or recirculating the trickling filter effluent.

The effluent can be recirculated either from the outlet of the trickling filter or the bottom of the final clarifier to the head of the primary sedimentation tank or to the dosing tank. Recirculation is through a 6-inch pipe and the flow is so reduced the full capacity of the two pumps cannot be obtained. The capacity of a single pump is not sufficient to operate the trickling filter arm with no sewage flow.

The plant is designed for a population of 10,000 persons. The flow was based on 70 gallons per person per day or 700,000 gallons per day. Records indicate the flow last summer was close to 70 gallons per person but has increased to 90 gallons per capita this winter. The flow has recently dropped to 77 gallons per person per day. There is no apparent reason for the variation.

Sewage is recorded by a Palmer-Bowlus Flume. Sewage arrives at the plant at a very high velocity and one time it was noticed the recording meter was dropping as the flow was increasing. The sewage passes through the flume above its critical velocity and true readings are not recorded. This has been partially corrected by putting a bar screen ahead of the flume but the recorder can only be used to measure the length of time required for the flow to reach the plant and the daily quantity must be calculated from pump capacities.

There are two longitudinal flow primary sedimentation tanks 12′x40′6″ x12′ water depth equipped with Link Belt Sludge and Scum Collectors. The primary tanks have a detention period of 3 hours based on raw sewage flow. With recirculation at 650 gallons per minute, which is the maximum

for both recirculating pumps, the average detention period is 1.2 hours. Periodic detentions are lower than this when two of the main sewage pumps are on.

The dosing tank with a 16-inch syphon is located on the end of the primary sedimentation tanks. It is calculated to discharge 20 million gallons per acre per day to the trickling filter. In order to operate the plant as a true biofilter plant, the dosing tank has been disconnected.

The trickling filter is 55 feet in diameter by 6 feet deep with no provisions for ventilation. The filter is designed on the basis of 30,000 persons per acre foot or 3.2 pounds of Biochemical Oxygen Demand per cubic yard based on raw sewage load of 0.17 pounds per capita per day.

The final clarifier is a Dorr Radial flow circular clarifier, 35 feet in diameter and 11 feet effective water depth. It is also based on a 3-hour detention period without recirculation. Sludge can be pumped direct to the digester or to the primary clarifier. The latter method is the procedure practiced.

Chlorine can be added at the inlet to the chlorine contact tank for disinfection of the effluent or to the dosing tank for odor control. There are two Everson Chlorinators with total capacity of 400 pounds per day. The chlorine contact tank is a circular conical tank with a submerged side inlet and side surface overflow. The average detention period at designed load is 30 minutes.

Two stage digestion with heating coils in both digesters is provided. Both digesters are 28 feet in diameter and 24 feet side wall depth. Three cubic feet of sludge capacity is provided in the basic design. The digesters are operated by pumping raw sludge into the top of the first digester and a corresponding volume flows from the bottom of the first digester to the bottom of the second digester. Overflows are located on the second digester at 7 feet, 15 feet, and 23 feet below the surface. Supernatant liquor can be returned to the primary clarifier or run direct to the sludge beds. Sludge can be either pumped from the digester or taken off by means of the overflow. Provisions are made for recirculating the sludge in either tank by the sludge pumps. Gas is collected and stored in a gas holder 10 feet in diameter with a capacity of holding 950 cubic feet of gas. Four undrained sludge beds with a capacity of 25,000 cubic feet are provided with 2.5 cubic feet per person.

You may see by the foregoing description, the operators have no small job in operating this plant. The plant was operated using the dosing tank with and without recirculation but the results were always poor and the filter would become flooded. At one time the filter was pooling on at least 75 percent of the rock surface. As soon as the dosing syphon was disconnected and recirclation started, the effluent would improve. To make sure whether the dosing tank should be used, it was again put in service when the filter rock was green with algae and the effluent was as good as it had been since the beginning of the operation of the plant. Within two weeks, the filter was flooding and the algae had turned gray. With this experience, the plant has since been operated with the dosing syphon disconnected.

Sludge is drawn manually every hour into hoppers at the end of the primary sedimentation tank. Until recently, sludge was pumped daily to the digester so as not to interfere with recirculation but the sludge is too thick to be handled by the centrifugal sludge pumps and water had to be added to keep the material going through the pumps. The sludge is now pumped more frequently, but this has not completely solved the problem. About 6000 gallons of sludge is pumped daily, averaging 5.5% solids.

Having multiple use, pumps for sludge and recirculation had led to some difficulty. Normal circulation is interfered with when sludge is pumped. Also, sludge is left in the lines and a certain portion of sludge is pumped back into the already overflooded primary. One time the operator had the experience of pumping sludge into the trickling filter through the dosing tank much to his embarrassment as the filter arm clogged and the dosing tank flooded.

The trickling filter rate with recirculation is around 36 M.G.A.D. at normal flows and probably gets close to 50 M.G.A.D. with more than one main sewage pump on. However, this is only for one or two short periods of 5 to 10 minutes a day. This peak is close to the capacity of the underdrain system of the filter and if this high flow occurs for any length of time, the recirculation pumps have to be shut off to prevent flooding the plant.

The sludge beds might have given some trouble this winter if it had not been for the large sludge bed capacity. The beds are undrained and the soil holds water like concrete. The beds filled up with rain which mixed with the sludge and the sludge is still drying.

With all of the difficulties encountered in operation, the chemical results produced by the plant are surprisingly good. The plant has operated at about 85% of its designated capacity until this spring when the full capacity was reached. When the plant was first put into operation and until this winter, the sewage flow averaged about 70 gallons per capita per day and the B.O.D. figured close to 0.17 pounds per captia. However, during the winter, the flow has increased close to 90 gallons per capita and the B.O.D. increased to around 0.20 pounds per capita. The per capita flow is dropping and is now 77 gallons per capita per day. The increase may be due to the inaccurate pump capacities used at first or to the use of new garbage racks installed during the winter which are connected to the sewer. The increased B.O.D. could be attributed to garbage.

The sewage arrives at the plant with a B.O.D. of around 285 parts per million and the effluent has a B.O.D. of 40 to 45 ppm. with a total removal of 85%. It is also observed that regardless of the strength of the sewage arriving at the plant the percent reduction still remains about the same.

The reduction of suspended solids is about the same as the B.O.D. The suspended solids in the raw sewage average about 335 parts per million and figures 0.24 pounds per capita per day. The effluent averages 45 parts per million. The overall reduction of suspended solids is 86%.

Relative Stability is the test that tells as much about the operation of this plant as any test run. The stability is low and the test responds very quickly to the character of the effluent. As soon as solids rise in the final clarifier, the stability will drop to less than a day. The average stability

at the plant average 35% during the fall months and has dropped to as low as 16% during the winter months. It has averaged as high as 57% during the warmer weather.

During the winter the trickling filter turned a grayish color. This may be due to colder climate, less sunshine or more likely due to a fine silt deposited on the rock due to surface run off in Camp. As soon as the rains ceased the filter improved and turned green.

Special studies have been made on the plant which include plans for enlargement, methods for temporary improvements, and utilization of chemical precipitation but time is limited so this paper has been confined to the operation only.

Discussion:

MR. ALLEN: How can you determine your capacity from your pumps?

LT. FOSTER: The pumps have been redesigned and the impellers cut down to 675 to 1000 GPM. We have a very good method of measuring pump capacities by measuring the rate of inflow and outflow. The sum of the two is the capacity of the pump and can be measured quite accurately.

QUESTION: Yesterday at Minter Field I couldn't see any method of flow measurements.

ANSWER: The way they actually measure the flow, they have a recording device that tells when the pump comes on and when it shuts off, adding up the total minutes the pump is on, and multiplying that by the pump capacities, giving the total flow.

LT. FOSTER: When the Camp Callan plant first started a lot of the pump capacities were estimates. I would check at different times and, comparing the chart from one day to the next, you could tell whether the pump was throttled or not by the height the flow would be measured on the chart. It was anywhere from 1000 to 1800 GPM. A lot of the earlier flows are guesses and that 70 gallons per capita may be in error. My experience at the plant has been that the Palmer-Bowlus flume gave very erroneous results and therefore other methods had to be used to get the sewage flow.

MR. BOWLUS: I wish Mr. Palmer and I could be consulted about that flume, as I am certain it was not properly installed.

LT. FOSTER: I am hoping to get a grit removal tank ahead and get the grit chamber to act as a settling basin and increase the velocity before it enters the flume. It is located practically right at the end of the pipe.

MR. BOWLUS: It is all right to have the flume at the end of the pipe but what is below the flume?

LT. FOSTER: The recirculation line comes in about 2′ below the flume.

MR. BOWLUS: I am afraid that is not very good advertising for our flume!

MR. PALMER: I heard of the flume down at Camp Callan from Mr. Richardson of the Bailey Meter Company, who said the trouble was that the invert of the flume was several inches below the invert of the weir in the tanks below, so that when the pumps were not running water stood seven inches deep in the flume.

LT. FOSTER: That is not true! The recirculating stream maintains a head of water immediately below the flume at all times.

RESEARCH ON SULFIDE CONTROL

By RICHARD POMEROY* and FRED D. BOWLUS**

The research which has been carried on by the L.A.C.S.D. during the last three years on sulfide control is still in progress. The general principles have been fairly well explored, but in the next few months some refinements and elaborations of the data will be made. Consequently a final report is not being published at this time but a few of the interesting conclusions, as presented at the C.S.W.A. convention in Bakersfield, are here given in abstract form.

In free flowing sewers sulphides are produced only by slimes on the submerged surface of the sewer and by deposited sludge. In the flowing body of the sewage sulphides are not generated but on the contrary are destroyed by oxygen which is continually being absorbed from the surface.

The rate of generation is proportional to the B.O.D. of the sewage and to the area of biologically active surfaces. The rate increases 7% for each degree Centigrade rise in temperature. The optimum pH is between 7.5 and 8.0. For a B.O.D. of 400 and a temperature of 20° C. the rate of sulfide production is about 2½ lbs. per 100 square feet of active surface per day. But the amount reaching the end of the sewer is always substantially less than the amount generated, since a part is lost by oxidation and by escape of H_2S.

In larger sewers the amount of sulfide escaping to the atmosphere is usually very small compared to the amount carried by the sewage.

Due to the rapid conversion of H_2S to H_2SO_4 on the exposed sewer walls, the atmospheres are generally far from equilibrium with the liquid. Saturations of 5% to 10% are generally found. Calculations of the rate of production of sulphuric acid in the L.A.C.S.D. system gave results which adequately account for the observed depths of penetration of concrete. In order to assure a life of 100 years for the largest sewers of the L.A.C.S.D. it is necessary that dissolved sulfide concentrations shall not average more than 0.1 p.p.m.

Significant points in the discussion of 13 control measures are as follows: For any temperature-B.O.D. condition there is a minimum velocity of sewage flow which will provide sufficient oxygen to destroy the quantities of sulfides produced. Such velocities can be predetermined from data now available.

Pre-chlorination to prevent sulfide generation was found to be much less efficient than destruction of sulfides by chemical action of chlorine.

Dissolved sulfides are precipitated quantitatively as ZnS when zinc salts are added to sewage. If the zinc salt is added at the upper end of a line in suitable concentrations, dissolved sulfides may be completely blanked out of the entire line. However, the conversion of dissolved sulfides to zinc sulfide prevents the oxidation which normally occurs, and thus the desired quantity

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of zinc is greater than would be calculated on the basis of dissolved sulfide concentrations found in the absence of zinc.

Ferrous salts can be used economically if high dissolved sulfide concentrations are to be reduced to a level around 1 to 2 p.p.m. In order to reach lower concentrations it is necessary that some oxygen be present. In free-flowing sewers there is generally enough oxygen in the sewers so that dissolved sulfides may be economically reduced to 0.5 p.p.m. at the point of application. Apparently FeS_2 is a product of the reaction. Ferric salts are less effective than the ferrous, but mixtures of ferric and ferrous and also Scott-Darcey solution are more effective than either pure ferric or ferrous. With all of the iron salts, however, the effectiveness declines after mixing with the sewage so that subsequent sulfide generation will allow concentrations of dissolved sulfides to reach 1 to 2 p.p.m. even in the presence of an excess of iron.

Ammoniation of the sewer atmosphere is suggested as a means to counteract disintegration by sulphuric acid. Since the amount of hydrogen sulfide escaping is usually small, and since ammonia is cheap relative to its small reacting weight, this procedure is much more economical than chemical treatment of the sewage. In a representative case it was calculated that the chemical cost for ammoniation would be only one-tenth of the cost of chlorination even if a three-fold excess of ammonia were used to assure complete protection.

OPERATORS' SYMPOSIUM, APRIL 26, 1942

GAS ENGINE OPERATION

MR. PALMER (L. A. County Sanitation Districts): We have been using gas engines since about 1935; the first 2½ years competing with the power at 0.65 cents per KWH we saved around $15,000. During the last four years we have had two engines, one a standby, hooked up to generators. While we do not use much power now, we are saving about $800 a month; the load being about 65,000 or 70,000 KWH per month. We cut off from the Edison Company about a month and a half after we started, and we have not had to shut down on account of engine trouble. The only trouble has been with the cooling tower which is a little small. Once in a while on a hot summer day we have difficulty in cooling the engines. We have just contracted for two more 120-HP gas engines for intermittent work. We have had no trouble from hydrogen sulfide gas because we run these engines constantly and they get no chance to cool. They are on the line six months at a time and we get two or three short shut-downs in that time. By keeping them hot, hydrogen sulfide hasn't bothered us in the least. I understand it is advisable to run the engines hot. The cooling water in the older engine is about 135°. The engines which we are purchasing will run spasmodically at about 165°. The higher temperature will make the cooling problem less difficult.

With regard to maintenance, we entered into a contract with the agents who sold the engines, paying them 3/100ths of a cent per HP hour. At the expiration of the contract they overhauled the engines, put in new piston rings; and Mr. Hegeman told me that he estimated it cost them about .01c, most of that being for a man going to see if the engine was all right! This shows that the maintenance cost was really very little. We have found since 1935 that the engines are a very reliable source of power for a plant like the joint disposal plant of the Sanitation Districts.

QUESTION: Does the acidity of the cylinder oil build up at all?

MR. PALMER: No. The company that contracted for the maintenance told us they would like to see us try Triton oil. The Union Oil Co. sent a man around about every month to test the oil. He always reported no troubles, so Tennant accused them of coming around to test so often just to increase the oil consumption! When they changed the piston rings we all asked why—the engine was in such good shape. They said it was getting hotter than they liked so they wanted to put the piston rings in to avoid trouble. The Union Oil man asked what the mileage was. That had me stumped, to find the mileage of a stationary engine running at variable speed! A rough calculation, figuring 2000 revolutions to the mile, amounted to 240,000 miles—equal to the distance to the moon! The small wear on the rings tells you about what has happened to the oil.

MR. COOK: Did they use a filter on that oil?

MR. PALMER: Yes.

MR. CASTRO (Santa Clara): How many cubic feet of gas are required per KWH?

MR. PALMER: About 20 cu. ft. per HPH at 90% generator efficiency—or about 30 cu. ft. per KWH.

MR. ERICKSON: Our engine is run that way. The only thing is that the Pacific Enterprise Company have had many in service for several years, quite a few scattered around the oil fields. The Union Oil Company has a large engine with a sealed system on the radiator. Our engine runs at 233° and does not seem to have so far any bad effects except on the temperature inside the building. So much of it radiates from the engine, I am afraid it will be terrifically hot in the summer time. The high water temperature will eliminate hydrogen sulfide. From what I have seen of these engines running on natural gas in the oil fields at that temperature, they seem to be doing a pretty good job.

PRE-HEATING OF SLUDGE BY STEAM

By VINTON BACON*

Mr. Tennant, our Chief Operator and Supt. at the Los Angeles County Sanitation Districts Treatment Plant, is unable to be with us at this meeting, and I have been asked to pinch-hit for him and tell you something of our revised sludge heating system.

Sludge from the plain sedimentation tanks is pumped into a seeding tank. After seeding with approximately 20% of digested sludge it is pumped to the digesters, a distance of some 600 feet. Before revision of the system, sludge heating was accomplished by means of water coils *in* the digesters.

Upon the enlargement of the digestion facilities it was decided to depart from the water-coil method of heating and to utilize live steam as the heating medium. Now a 4-inch steam line runs from a 70-H.P.-H.R.T. boiler to the sump in the seeding tank, a distance of approximately 200 feet. To heat the sludge a valve in the steam line is slowly opened, injecting live steam into the sludge. The original idea had been to immediately start pumping the sludge to the digesters after opening the steam valve and to heat while pumping. Some preheating has been found desirable and further accomplished by heating, pumping and recirculating the sludge back to the seeding tanks along a line from the pump outlet. The final heating is continued while pumping to the digesters. (See accompanying diagram.)

Temperature control of the sludge is provided by means of an indicating thermometer inserted in the suction line of the sludge pumps and existing electrical thermometers at the digestors. By raising the temperature of the sludge to 87°F. at the pumping plant, a 2° transmission line loss is allowed

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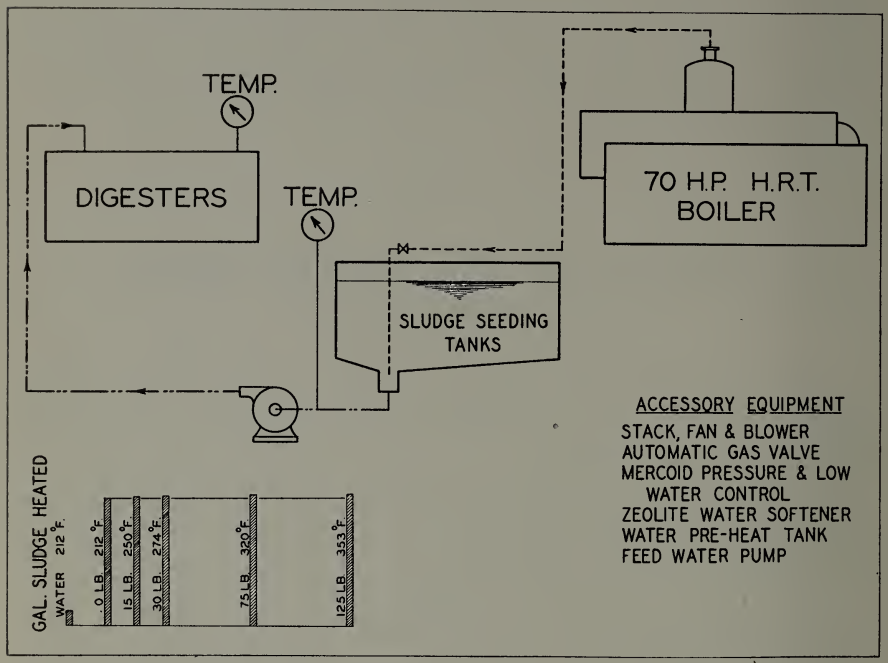
for and the desired 85° F. temperature at the digesters is obtained. The electrical thermometers will later be used more as checks, after the establishment of the operating schedule.

Operating and plant results are meager to date since the system has been in use only since last month, although it appears that the method will be satisfactory. Odors at the seeding tanks have been one of the big worries, but as yet none have been observed although temperatures as high as 130° F. have been obtained at these open tanks.



It might appear that the operator hasn't much more to worry about than the opening and closing of the steam valve and the operation of the sludge pump. The set-up consists of considerable more than that when the important incidentals to the operation of a boiler of this type are included. Here are listed a few of these accessories:

A stack, fan and blower
Automatic gas valve
Mercoid pressure and low water control
Zeolite water softener
A feed water preheat tank
A duplex reciprocating steam feed water pump

I would like to illustrate an important operational point pertaining to

the value of high or low steam pressures for heating. Consider the number of gallons of sludge which can be heated 10° F., which will approximate our average yearly temperature rise, for every gallon of water converted to steam at pressures of 0, 15, 30, 75 or 125 lbs./sq. in. At these steam pressures the corresponding saturated steam temperatures would be 212°, 250, 274, 320 and 353° F. at the 125 lb. per sq. in. pressure. Upon first thought it might seem that the higher steam temperatures and pressures would have more heating capacity. Actually only 4% more gallons of sludge can be heated at the 125 lb. pressure than at the 0 lb. pressure, the figures being of the order of 114 and 110 gallons, respectively. Since transmission line heat losses will be greater at the high temperatures, which factor will result in more condensate in the line, and since accident hazards are greater at higher pressures and temperatures, it seemed desirable to maintain as low a pressure as feasible. We are operating at 20lb./sq. in., which pressure was found necessary to operate our reciprocating steam feed water pump.

SLUDGE HEATING DURING DIGESTION FOLSOM PRISON TREATMENT PLANT

By **THOMAS GWIN***

There are a number of reasons why artificial heating of sludge during the digestion period is desirable, and in most cases, necessary. We are all more or less familiar with the more important of these reasons, and I shall therefore gloss over them lightly before touching on a phase to which, I believe, the average operator has given but little, if any, attention.

Sludge digestion, as we all know, is the process of reducing the complex organic sewage solids to simple, more stable substances through anaerobic decomposition. The progress of digestion is measured in terms of the amount of volatile matter destroyed and the volume of gas produced. The rate at which digestion takes place is greatly influenced by the temperature maintained in the digester.

There are two important temperature zones in which digestion occurs. The first is the high-temperature zone, ranging upward from approximately 100° F., in which *thermophilic* organisms are responsible for digestion. This zone is rarely maintained on account of odor and operating difficulties.

The second zone is that of moderate temperature, with an upper limit of approximately 100° F. In this zone, which is the one used by practically all treatment plants, digestion is accomplished through the activity of the common *mesophilic* organisms.

Messrs. Imhoff and Fair have presented a chart showing the "Time Required for 90% digestion of Sewage Sludge at Different Temperatures." The rates of digestion shown on this chart are measured in terms of the length of time required to complete 90% of the ultimate gas production.

*Chief Operator, Folsom, Calif.

This graph shows the time required for 90% digestion at 41° F., to be 100 days, while the time required for 90% digestion at 95° F. is shown to be approximately 24 days. This latter time of digestion, incidentally, is shown by the graph to be the approximate point of maximum efficiency for the moderate temperature zone.

According to the same authorities, digestion can be 90% completed in the high temperature zone in about 14 days at a temperature of approximateley 130° F. As I have previously stated, however, this temperature is impractical for various reasons, and is rarely maintained.

According to experience and the best authorities, maximum efficiency of operation for sludge digestion, in the moderate temperature zone, is achieved by maintaining a temperature somewhere between 85° and 95° F.

At Folsom we maintain an average digester temperature of approximately 90° F., as we have found by experience that this gives the most satisfactory results.

In temperate climates it is impossible to maintain temperatures that will insure a satisfactory digestion period without artificial sludge heating. There are several ways of doing this. Some plants introduce hot water, or hot sludge liquor, at the bottom of the tank and withdraw it at the top of the tank, after cooling, along with normal sludge liquor. While sludge thinning by this method is a disadvantage, water can be introduced at a temperature up to 180° F. and relatively high temperatures can be maintained.

Another method is to heat the incoming sludge in a counter current heat exchanger, but this method offers difficulties in the control of tank temperatures.

At Folsom Prison we use the more common method of circulating hot water through a bank of four stationary coils which encircle the inner side of the digester. The water is heated to a temperature of 120° F. by means of an "Ideal" gas-fired boiler before circulating and returns at a temperature of approximately 100° F. We have found that this temperature is sufficient to bring the temperature of the incoming sludge up to that of the digester, to compensate for heat losses through imperfect insulation and evaporation of the water into gas, while at the same time maintaining an average digester temperature of approximately 90° F.

Our experience at Folsom Prison has been in line with that of others using circulating coils. It has shown this to be a very satisfactory method of maintaining a flexible temperature control which is readily adjustable to changing conditions, and permits a temperature to be maintained which will allow digestion to be completed within a satisfactory period.

MR. GWIN (Discussion): I can give you some data on our experimental work at the Represa Plant. The digesters that we have at Folsom so far have to be different from any others. I will give you only the experience at our own plant. We have digested as high as 130° F. and down as low as 86°. If you can hold the digester at 130° you can get better digestion. We find it a difficult job to keep it up to that temperature with the heating unit we have. We can hold it between 90° and 95° and find this very successful. We can make about a 98% digestion in 24 days.

Our small gas heating unit carries about 5 lbs. steam pressure, which circulates back to the boiler. The water is sent over to the digester at about 120° to 130°. That will hold a digester up in good shape running about 18 hours out of 24, but as I say, if we could keep it up at 130° we could do better, and for that reason we drop back down to 90° and 95° because we can hold it there and get a better job without any extra work on our heating unit. The fuel gas is used as fuel from the digester. I would like to hear more about heating these digesters, particularly those having a return back to the primary, to take care of the surplus water which we have no way of taking care of. We have to decant before our sludge goes into the digester. If we could decant the digester back to our primary we could probably go for a day or two and give our sludge a better pH. We have brought our pH up to about 7.3—or 7.5—I think that is a pretty good record for sludge. About 7.3 is as good as we can do.

MR. BOWLUS: Mr. Gwin, Mr. Reinke would like to know how you measure that 98%.

MR. GWIN: We will have to see Dr. Day to give us his explanation on that 98% digestion. He gave me a report of 98% of all solids being digested in that number of days.

MR. REINKE (California State Board of Health): Do you handle activated sludge?

MR. GWIN: After it is in the digester we have no way of getting it back into the primary. Many digesters have an overflow that leads back and then they never run a digester over.

MR. CLARK (Huntington Beach): I was wondering about the overflow. Would it be very much trouble to just plug in a pipe line?

MR. GWIN: You would have to get a baffle in there.

MR. CLARK: No, up on top there is a floating mass and below settled sludge. Between the two masses is a liquid. There is where your pipe line should come from. When your heavy sludge gets up to the supernatant liquor, it's time to draw and you have to draw whether it is ready or not.

MR. GWIN: I have had in mind putting a by-pass right through to the primary. We have had enough trouble and do not want any more. Our tank holds about 1500 gallons. There is no trouble for these fellows who have overflow pipes.

MR. CLARK: You either have it all digested or you have none. It will practically all be digested. You can keep putting in and drawing off—it is always digested. Any time you want it just go out and get it. This bleeding back action is what gives the good digestion.

MR. GRAY (Berkeley): In getting up to 120° and 130°, is that temperature maintained in both tanks?

MR. GWIN: No, that is in two tanks or decanters.

MR. GRAY: How long did you have it at 130°?

MR. GWIN: Twenty days.

MR. GRAY: Did you notice any difference in the odor of the sludge?

MR. GWIN: Well—we don't have any odor!

MR. GRAY: I'm glad to hear it. Those who have tried high temperature digestion find the sludge has been rather stringy and tarry—unpleasant digestion.

MR. REINKE: Perhaps Mr. Gray forgets, Mr. Gwin's plant won first prize last year!

MR. CASTRO (Santa Clara): Did you say 15% or 50%?

MR. BACON: Fifteen.

MR. CASTRO: Does he put in about 25% per volume of seed sludge?

MR. BAUGH (Los Angeles County Sanitary Districts): I had quite a discussion with Mr. Tennant on the percentage of sludge. He uses 20% seeding sludge, i.e. 20% of the raw, e.g., 25,000 gallons of raw plus 20% seeding would be 30,000 gallons, or the seeding sludge is 17% of the total gallonage.

MR. GWIN: I was not laughing about your idea on the steam. We tried heating our decanters by putting in steam coils. It worked fine until the odor became bad, so that is why we dropped back in our temperature.

QUESTION: I was wondering about putting your live steam in your decanter. You have a centrifugal pump—is that steam going to make an air pocket to give you a lot of trouble?

MR. GWIN: I will admit I had not thought of putting it through the pump. That would give you a lot of grief. I was wondering if I still had a chance of heating it in the decanter?

MR. BACON: The question is whether or not the 20-ft. length of pipe is sufficient for the vapor to be condensed before reaching the pump. So far Tennant has reported no difficulty and it is working fine.

MR. WISELY (Urbana, Illinois): Mr. Bacon, what is the heat loss through your digesters?

MR. BACON: We have four tanks in each battery and the sludge goes from tank to tank with a loss of about 1°. In the older tanks they originally had 12 coils to a tank. They found it unnecessary to use heating coils except in the first tank.

MR. CLARK: Just as a point of information, I would like to know: have you had experience pre-heating sludge before putting it through the digesters? I have no opportunity to inject live steam. I would like to know if there is such a thing as a heating coil to pre-heat the sludge—has there been anything done along that line?

MR. MAY (Palo Alto): At Palo Alto we had to do that. Our coils gave way and we didn't want to empty the digester. We have a sludge pit that we bring our raw sludge into and then pump to the digester. We placed coils in this pit, pre-heated sludge and passed it on to the digester. Coils were placed around the walls.

QUESTION: Was the heat consistent throughout the digester?

MR. MAY: Yes, the temperature of the digested sludge, as we take it off the bottom was maintained at the same figure. We leave this heat on for one hour. If we have to pump sludge faster then the temperatures drop. I believe pre-heating sludge is the thing to do because you can control it better. It is easier to get into an open pit to repair the coils.

MR. BOWLUS: Approximately, what is the temperature in your digester?

MR. MAY: About 28° C.

MR. REINKE: Is there any information on the heat loss through the steel digester tanks at the San Luis Obispo camp?

LT. McKEEN (Camp San Luis Obispo): No, but there is quite a loss all right, but I do not know what it is. I have no way of computing it.

Sprinkling Filters

MR. CAREY (Tracy): I have been playing around with the Tracy sewage plant, trying to determine whether it will work or not. They are having trouble with slaughter-house waste, and those little red worms going into the filter beds. We had the burner killing off worms.

QUESTION: Can't the birds help take care of the worms?

MR. CAREY: There are not enough birds to handle *those* worms—they collect three inches thick and cover an area five feet in diameter.

MR. CASTRO: Do you chlorinate?

MR. CAREY: We have no chlorinator.

DAIRY WASTES

PRESENTING SCREEN CHAMBER PLAN FOR DAIRIES CONNECTED TO SANITARY SEWERS

By ARTHUR PICKETT*

I have been requested to present, for the consideration of this group, the new standard of the County of Los Angeles for the connection of dairies and dairy facilities to the sanitary sewer system.

Recently we have had considerable trouble in the maintenance of our main-line sewers, due to deposits of large amounts of silt, gravel and other detritus from dairies connected to the sewer system. Inspection has proven that this condition is caused primarily by screen chambers which are improperly constructed or maintained.

Inspection of a large number of these dairies revealed that the difficulty was largely due to the fact that the dairymen were not acquainted with the law; that, in many cases, their screen chambers were inadequate and, in almost every case, were improperly maintained. We also found that the dairymen universally considered the sewer to be a storm drain into which they could empty the water from roofed areas, paved ramps, walk-ways, silos, feed racks and other sources, contrary to provisions of the Sanitary Sewer Ordinance.

As these dairies are located on a flat coastal plan, where the ground-water table is high, it is essential that provision be made for disposal of the wash water from the milking barns, milk houses, toilets and other similar

*Deputy County Engineer, Los Angeles County.

sources as an aid in production of better market milk for the entire Los Angeles area.

A large percentage of the dairies which supply milk for a population of more than 2,500,000 persons are located in this area. As these dairies vary in size from a few milk cows to herds of almost 2000 cattle, the problem is complicated.

Most of these dairymen have extended long lines for connection to the sewer system at considerable expense to themselves and we encountered great resistance from them in our attempts to enforce the Sanitary Sewer Ordinance and to correct the conditions encountered. In many cases they contended that the conditions which we are attempting to correct were brought about in their attempt to comply with orders of the sewer or dairy inspectors.

In order to clear up this situation, we called upon a number of the dairymen and also upon Dr. R. P. Gingerich, Market Milk Specialist of the State Department of Agriculture; Mr. Mark D. Howlett, Jr., Chief Milk Inspector of the City of Los Angeles, and Dr. F. P. Wilcox, Chief of the Dairies and Dairy Products Section of the Los Angeles County Health Department.

These conferences revealed that there was some conflict between our sewer requirements and the requirements laid down by the dairy inspectors. We therefore worked out a standard screen-chamber plan and instructions for connecting the drainage from the dairy to the sewer so as to eliminate all discrepancies. Dr. Gingerich, Mr. Mark Howlett and Dr. Wilcox expressed the wish that these standards could be presented at this meeting and, if possible, adopted throughout the State so that dairymen in Kern County, for instance, could construct their milking barns and screen chambers in such a way that the production plant would meet the requirements of Los Angeles City or County Milk Inspectors. Compliance with these standards would make it possible for such dairymen to market their milk in the Los Angeles District if it became desirable to do so, providing, of course, that other requirements imposed by the Department of Agriculture, Health Department and other officials were met.

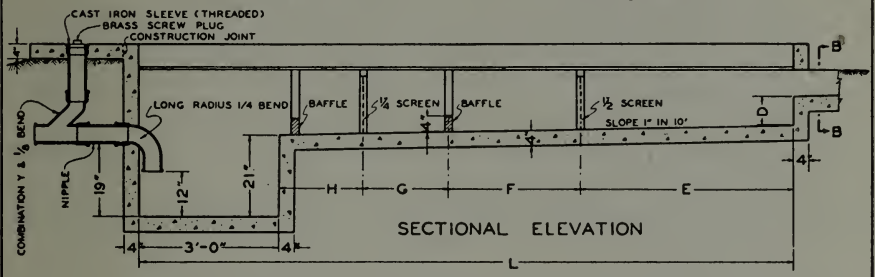
This screen chamber is a modification of the plan developed by Professor H. B. Walker of the University of California, Division of Agricultural Engineering. Where no sewer is available the chamber can be utilized to advantage in disposal of drainage water until such time as a sewer connection can be made. By the connection of a pump which is located just below the screen chamber the effluent, in most cases, is discharged through this pump onto adjacent alfalfa fields for irrigation.

The advantages of this screen chamber and of the requirements which we have formulated for its use are:

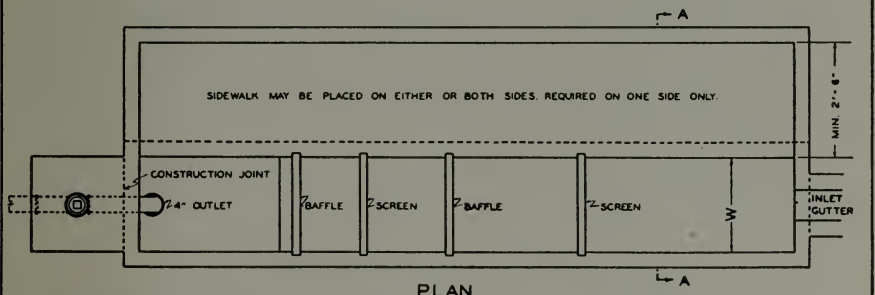
1. The relatively low cost of the installation.
   Some of our dairies have very few cows; others milk nearly 2000 head. When you can get a chamber that is inexpensive and that can be used for either the little dairy or the big one, you have something!
2. The ease of maintenance and operation.
   We have found that it is easy to maintain and operate this chamber,

COUNTY OF LOS ANGELES
CALIFORNIA
OFFICE OF COUNTY ENGINEER
SCREEN CHAMBER FOR DAIRIES
ALFRED JONES COUNTY ENGINEER

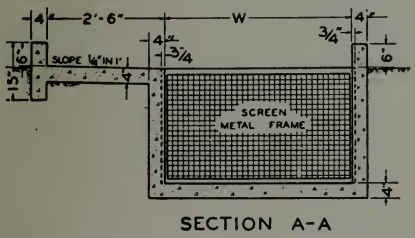
Recommended _____ CHIEF DEPUTY Approved _____ COUNTY ENGINEER



SECTIONAL ELEVATION

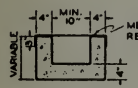


PLAN



SECTION A-A

NUMBER OF STANCHIONS	DIMENSIONS						
	L	W	D	E	F	G	H
24 OR LESS	10'-0"	2'-0"	7"	3'-6"	1'-6"	1'-0"	1'-0"
26 TO 40	15'-0"	2'-2"	8"	5'-0"	3'-0"	2'-0"	2'-0"
42 TO 64	22'-0"	2'-8"	8"	8'-0"	4'-0"	3'-0"	4'-0"
66 TO 88	30'-0"	3'-0"	9"	12'-0"	6'-0"	4'-0"	5'-0"
90 TO 120	40'-0"	3'-6"	9"	16'-0"	8'-0"	6'-0"	7'-0"



SECTION B-B
INLET GUTTER

NOTE: THIS IS A MODIFIED PLAN OF THE UNIVERSITY OF CALIFORNIA, DIVISION OF AGRICULTURAL ENGINEERING, LOS ANGELES SCREEN CHAMBER PLAN NO. 8 BY H.B. WALKER

DRAWN	KAUFFMAN	APR. 1942
TRACED	ALEXANDER	APR. 1942
CHECKED	COLLINS	APR. 1942

providing a little educational work is done among the dairymen.

3. Freedom from stoppage and the ease with which roof drainage and other storm waters are excluded from the system.
4. The establishment of a standard plan which provides one more basis upon which dairies can be uniformly graded.

Previously a poorly constructed or improperly operated screen chamber was one of the reasons for rating down a dairy and dairymen were often at a loss to conform with the requirements made by the various inspectors.

The essentials which must receive primary consideration are:

1. That the chamber must be constantly maintained and should be cleaned each day after the morning milking in small dairies. However, for the big herds, we have found it desirable to have the chamber cleaned after each milking when the cows are washed down.
2. That no connections from toilets should be connected into or above this chamber.
3. That the screens and baffles should be installed as shown on the plan and should be kept in place at all times, except when the chamber is being washed down after cleaning.
4. It is also very important that the various dimensions be followed closely and that the depth of the sump be no greater than that shown on the plan.

We have found that if these chambers are properly maintained, objectionable odors are avoided and that very little material collects in the sump which ordinarily doesn't need to be cleaned more than once in six weeks as the majority of the material is collected in the upper portion of the chamber which is cleaned after each morning milking.

We hope that any of you in other sections of the State who have dairies to contend with will see fit to follow the same general plan which we have adopted. The instructions as approved follow:

DRAINAGE TO SEWERS

FROM MILKING BARN: Wash water from the milking barn is permitted to be discharged into the sanitary sewer only if all the following requirements are met:

1. A licensed sewer route connection contractor shall take out a permit therefor at the office of the County Engineer, 7th Floor of the Union League Building at 2d and Hill Streets, Los Angeles.
2. The completed construction must pass inspection, test for water tightness (leaks) and be mapped and approved by the inspector of the County Engineer's Office.
3. The water must pass through a standard screen chamber of the proper size as shown on Standard Plan No. S-a-101.
4. The connection with the sanitary sewer must be constructed so that storm water from roofs, unroofed paved areas, ramps, platforms, floors, or any other source, cannot drain to the sewer.
5. The outside walls of the screen chamber must extend not less than 6" above the surface of the ground and no water other than that from inside the milking barn shall be permitted to enter the screen chamber. All pipe and fittings in the screen chamber shall be Cast Iron Soil Pipe.
6. The hub for the 4" cleanout plug shall be brought up level with the top of the 6" curb and shall be protected by a 4" concrete apron.
7. A clear concrete walk way 30" in width must be provided along the full length of the screen chamber on one side to facilitate cleaning and inspection. The

walk way may be washed into the screen chamber if the 6" curb wall is extended around the outside to include the walk.

FROM MILK HOUSE: Floor drains in the milk house may be connected directly to the sewer connection and need not pass through the screen chamber, but must meet the following requirements:

1. Milk house drainage should be through floor drains provided with screens to exclude trash and have a satisfactory water trap. (If milk house drainage is conveyed in a depression to gutter in milking barn, it must pass through a roofed area not exposed to storm water or outside wash water.)
   Permit must be obtained from the Plumbing Department when floor drains and wash basins are connected directly to the sewer.
2. A cleanout with plug shall be provided just outside the building on direct connections.
   When a closed drain extends from the milk house to the sewer, it shall be vented just outside the exterior wall, or within the exterior wall, with a vertical stack of the same size as the drain line and extended above the roof.
3. When located in an unroofed area, the waste piping from the wash basin between the pouring platform and the milking stanchions shall be connected to the sewer from the milk house and properly trapped and vented in compliance with Ordinance No. 2366 N.S., as amended. When located in a roofed area, it may drain on the surface to the gutter in the milking barn.
4. TOILET FACILITIES ON THE PREMISES SHALL BE CONNECTED TO THE SANITARY SEWER IN COMPLIANCE WITH ORDINANCE NO. 2366 N.S., BUT DRAINAGE THEREFROM SHALL NOT PASS THROUGH THE SCREEN CHAMBER.

OTHER DRAINAGE: No drainage from silos, paved yards, walks, ramps, feed racks or other location which could permit storm or surface water to enter the drain shall be permitted to enter the sanitary sewer.
If screen chambers are constructed under eaves of milking barn, an adequate roof gutter shall be installed to carry rain water away from the chamber.
The concrete inlet gutter shall have a removable sheet metal cover over the portion which is not under the roof.

MR. BOWLUS: Refuse from a dairy can cause a tremendous increase in the sulfides in just a few miles of the sewer line.

MR. RAMSEIER: I had an opportunity to study that manure settler as designed by Mr. Walker a few years back. John Clark and I ran quite a series of tests on one at Fairmont Hospital in Alameda County. We ran the usual tests for suspended matter and B.O.D. and on a dairy herd that was being milked three times daily.

Our results came out that the final effluent from that settler had an equivalent load very nearly equal to one human for one cow organically.

As far as the operation of the settler went, at this plant there was an old fellow taking care of the drains around the barns and he had the idea that everything should be held back in the barn troughs until it was time to overflow and then he would pull the plug and everything came down with a rush. This finer manure would go through the first screens and get caught on the last screen. When he went to clean out the settler, he would have about a foot of liquid that could not be handled. Much of the heavier matter stayed there, but some of the lighter materials went on through and settled in our weir box. But, with slight modifications of the effluent line in the one we studied, I think that fault could be practically eliminated so that it would be nearly fool-proof. It seemed to do an excellent job of taking out the coarser solids.

MR. HARMON (California State Board of Health): This had no sump?

MR. RAMSEIER: No.

MR. REINKE: Operation is the big thing. You can have a very fine design, but this screen chamber is of no value unless properly maintained.

MR. CASTRO: Did that old man ever work for a cannery?

MR. PICKETT: We have had one or two installed with perfect adherence to the plan. However, without an educational program the dairymen will not maintain it and we get all of the solids down the sewer. In one case, we had an extra maintenance cost of $600.00 in one year just on account of one dairy's failure to maintain its chamber. With figures like that you can get their cooperation very easily.

LT. FOSTER (Camp Callan): One person per cow,—is that on the settled stuff?

MR. REINKE: I think this subject is large enough that it might be the subject of a paper at the next conference because, on the item that Lt. Foster just mentioned (the population equivalent per cow), a great deal depends upon how carefully they wash up the milking sheds. The thing is so complicated I think it requires a little more study.

MR. PICKETT: As far as population equivalent is concerned, I was checking up on one dairy which milks 180 head. When they washed down their barn, they were pouring in ¾ of a second foot for a short period of time.

Down in Lakewood they paid $25,000.00 for similar capacity rights in the construction of their outfall sewer. One person per cow is rather small and I would like to have some check made of that figure. Maybe in other territories the dairymen are more careful or conservative than in our part of the State.

MR. BOWLUS: I think this is an important subject that has not been discussed at our meetings. This is a good start. We might want a committee appointed to study this source of waste.

MR. REINKE: It does seem to me that Los Angeles County has paid quite an honor to the C.S.W.A. by asking the Association to adopt their designs, but I think it is premature. I think we should cooperate.

MR. CLARK: Mr. Chairman, as long as we are "sewer rats," we might as well be dairymen!

MR. PALMER: I would like to make one suggestion. I think Mr. Pickett remarked that he got a little sand from these dairies. One of our great troubles was to trap sand. Someone has suggested all you have to do to make a good sand trap is to increase the cross-section and very gradually stop the water, with no disturbance at the end of the trap.

This design suggested by Mr. Pickett looks very good but I am afraid it would cause some turbulence at the entrance and around the baffles and this turbulence defeats the purpose for which they are built. In irrigation work we found that a very effective sand trap would be installed in a trapezoidal canal by increasing the slope of the invert to about 3.5% but maintaining the bottom width and side slope. This so streamlined the enlargement that there was no turbulence and the sand settled to the bottom

as soon as the velocity had decreased to the proper amount. A sluice gate at the lower end could be opened for cleaning and the steep slope washed out of all accumulated sand. Several of these were built and all were highly succesful.

I have always thought that an ideal scheme to put at the end of sewers. In one of those I put in up near Carson City the creek carried two grades of sand and also some water-logged bark. That sand-trap segregated those two sizes of sand, fine sand on the bottom, then the water-logged bark and the coarse sand on the the top. I believe they could be adapted with some little modification to the problem we have here for a small sewer.

I think, if we are going to look into these traps for a coming meeting that some such design as I have outlined should also be considered.

QUESTION: Any gold in that sand?

MR. BOWLUS: I don't think there is any action to take at this time. We are indebted to the County Surveyor's office for the work they have done.

QUESTION: Could this be referred to Mr. Knowlton and his industrial waste committee?

MR. BOWLUS: We can do that too.

GREASE TRAPS

MR. AVIS (Mather Field): In connection with sewer lines, discussing those as they apply to the plant itself, we in the Army camps are having a great deal of difficulty with kitchen grease. It plugs up the lines, clogs the valves, creates disturbance. I would like to hear from the Army post officers what they have done. We have developed a little grease trap that requires a little physical effort to keep clean but certainly eliminated our trouble with grease.

LT. FOSTER (Camp Callan): If you can get anybody to buy your grease, you will get a high price for it. The kitchens will take it to make soap, too. Our grease trap is just a little pot—holds about 20 gallons of water and is right underneath the tank. For a while they were getting about 75 lbs. of soap for a can of grease per week.

MR. AVIS: Our boys, too, take their grease and pour it into 55-gal. oil drums. Then they take them back and wash them. They salvage the grease but that in the sewer lines cannot be salvaged and goes to the sewage plant.

QUESTION: How much grease do they get out?

MR. AVIS: 4500 lbs. of grease in 28 days.

QUESTION: What is the size of your cantonment?

MR. AVIS: Between 4000 and 5000 men.

QUESTION: What type of treatment are you using?

MR. AVIS: Filtration—high-rate filter—single-stage digestion—two-stage worked into one stage.

QUESTION: Does your influent come into a sedimentation chamber?

MR. AVIS: To a flocculator, and then a primary clarifier. The grease trap is just ahead of the plant. We have tried pre-chlorination. One trou-

ble with that is they put it in the wrong spot. They should put it ahead of the comminutor and not behind it.

QUESTION: Will you please describe your trap?

MR. AVIS: It is 4 ft. wide, 20 ft. long. Still it catches a goodly quantity of grease. The water level is 18″ to 22″. The baffle is held up a foot off of the bottom. The flow seems to be rapid enough, so there is no accumulation of solids in the bottom.

MR. AVIS: We put the traps just ahead of the sewer plant itself. The grease isn't worth salvaging when we first take it out.

MR. BOWLUS: Do you have any deposit in the lines?

MR. AVIS: We found an inch and a quarter of grease in the lines. Before we built our grease trap the lines plugged up. We took a boring machine and bored out the grease. I have a water heater that we stoke with wood and coal and about once or twice a week I wash out those lines with plenty of good hot water.

LT. LUEBBER (Camp San Luis Obispo): We have four mess halls with 4000 troops.

LT. HOWELL (Camp San Luis Obispo): I believe the biggest difficulty with the grease traps is in the mess halls. They are too close to the fixture. When they wash the pans, the water is steaming hot and the grease goes through with the water and you look into the manhole and you see it beginning to form into globules—almost like pancakes. We get in touch with the medical inspector and make the mess sergeants watch the traps. Then the next week we get an entirely new group of men.

MR. PICKETT: Have you ever seen those traps up next to the sinks?

LT. HOWELL: Yes, made of cast iron with 4 baffles—2 up and 2 down; 20″ to 24″ square and 60″ to 80″ deep.

MR. RAMSEIER: I have been around a number of these air fields lately and the grease seems to be a universal problem. The difference between his plant and the others is that he had to put in a basin to keep grease, while most of the others have a pump sump. That pump sump catches the grease. We have had reports that as much as 800 lbs. of grease is taken out at one time from the walls of the sumps. We find in Stockton that there is a large sump and on top of the water in the sump is a thick layer of grease. The operator breaks that up and by-passes the plant and gets rid of the grease. Now there are other troubles caused by grease, some of which are plugging of the seal between the digester and the clarifier and the clarigester, and they have to surge the tanks to get that loose; and they get a big hunk of grease, showing by its shape that it was in that seal. We have had grease going through a high-rate trickling filter, past the final clarifier, appearing on the effluent ponds in quite large particles.

MR. REINKE: This problem of grease has been with us ever since we have been talking about sewage disposal. I saw a great deal of this during the C.C.C. days. The Army grease traps, purchased at plumbing supply houses, have only 10 to 15 or 25-gallon capacity, and hot water will run right through them, carrying the grease too. Mr. Hommon had this same problem in the National Parks and he found you have to have a tank of

large enough size to allow the water to cool to make a good grease trap. The water must be drawn off near the bottom of the tank. The Yosemite type grease trap is nothing but a square box with inverted pyramid bottom and a bottom outlet with a minimum size of 500 gallons. This gives plenty of opportunity for cooling and only has to be cleaned every three days. The Army types I have seen would have to be cleaned out after every mess and I do not think you would get very much grease.

MR. AVIS: Maybe I misled you when I said 4500 lbs. of grease, as that includes solids too. You cannot segregate 4500 lbs. in 28 days out of the grease trap. There may be half or less than half actual grease.

MR. GRAY: The thing that intrigues me is that we had the same trouble in the cantonments in the previous war. I am beginning to wonder if the Association has to suffer when men like Fred West die. He used to cuss the designing engineers thoroughly and well—and I think they still need it!

MR. DAVEY (Bakersfield): You boys have been crying about grease. I will give you something to smile about now. We got about 150,000 gallons of black engine oil at one time! Had to drain the clarifier when it was 3 inches deep on top.

MR. CLARK: I got a hundred barrels of oil—gas and oil. A pump line broke and a guy raised a manhole on the sewer line and over a hundred barrels entered before they discovered it.

LT. LUEBBER: At San Luis Camp there are two or three grease traps in each mess hall. By continuous process of education of the mess sergeants I think we have it under control. They look it over every day. The grease is collected by a contractor who uses it for soap. They are getting very little grease at the plant as about 80% of the grease is caught in the traps.

INSECT CONTROL

MR. GRAY (Berkeley): It wasn't until I looked at the program today that I suddenly remembered that I had been asked to talk about "bugs." Of course it wasn't mechanical "bugs," of which we have plenty. But I remember from reading Swift's "Gulliver's Travels" that Gulliver, on his voyage to Brobdignag was queried by the king of that country of giants about the habits and customs of England in Swift's time, and at the conclusion the king of Brobdignag remarked that, in view of what he had heard, this race of man must be "the most pernicious race of little odious vermin that Nature ever suffered to crawl upon the surface of the earth." In view of our present situation, with certain little brown vermin crawling and spreading over the Pacific, I am sure we are more interested in that form of insect extermination than we are in the minor bugs about our sewage treatment plants. I am sure that many of our operators would be most happy to put a lot of these yellow bugs through their comminutors.

You may remember that about 8 or 10 years ago Professor Herms of the University of California presented at one of our meetings a paper in which he described the various types of insects which may be encountered in sewage treatment plants. Among them were certain species of mosquitoes. Of these, *Culex tarsalis* breeds freely in open channels having extremely

slow flow, in tanks out of service, and in sewage ponds. It has a preference for water with a high organic content which is open to sunlight. Now, we did not give much attention to *Culex tarsalis* formerly, as it was thought to be merely a minor pest. But recently studies have shown that this mosquito is probably an improtant vector of encephalitis, a disease of the nervous system of man and various animals, especially horses. This disease has been prevalent in the San Joaquin Valley, and at times almost epidemic right here in Kern County.

We have a large number of military establishments in this valley, each with its sewage treatment plant, and it occurs to me that the possibilities of increased breeding fo *Culex tarsalis* this summer and autumn presents a very real problem which may have serious consequences to both civilian and military personnel. The spread of encephalitis by mosquitoes bred in improperly handled effluents is a definite possibility: we should recognize the problem, watch the disposal of effluents carefully, especially if they are ponded, and make certain that we do not breed this particular species of mosquito.

So far as the malaria transmitting species of mosquito are concerned, I feel quite certain that our sewage treatment plants present no appreciable problem, except possibly in the case of very highly oxidized effluents. Our California malaria mosquito, *Anopheles maculipennis freeborni,* definitely does not like polluted water, and will not breed in polluted or dirty water even if it is the only water available. In many years of experience I have not found this mosquito breeding in foul water, though it might breed in a thoroughly stable, well oxidized effluent. Therefore it seems probable that the breeding of malaria transmitting mosquitoes at our sewage treatment plants is not a matter of any concern.

Of course it is possible to breed the common house fly at sewage treatment plants, if screenings are piled for composting, but fortunately this is seldom done. Occasionally, also, you may find rat-tailed maggots, which are the larvae of the drone fly, breeding in the scum vents of Imhoff tanks, or in open digestion tanks, but this is not a matter of health significance.

The remaining insects which are of interest are the filter flies, the *Psychoda,* concerning which there are many articles in the literature. I had thought that the high-rate filters would do much to minimize this nuisance, but they seem to be more or less prevalent in the high-rate filters, as well as the standard-rate filters. I asked Roy Ramseier what he had observed at the military posts he had inspected, and apparently he found *Psychoda* breeding numerously in the high-rate filters.

QUESTION: What is the remedy for that first mosquito you mentioned?

MR. GRAY: If you are ponding your effluent, there is nothing that I would call a certain remedy for *Culex tarsalis.* It is probable that you will have to spray your ponds at intervals of about a week, using a petroleum derivative such as Diesel oil. The frequency will have to be determined by the plant operator, according to the breeding situation. I can't offer any exact schedule, as conditions vary so widely in different localities and at different seasons of the year.

MR. HARMON: Will fish work under these conditions?

MR. GRAY: Yes, if you are using continuous or oxidizing ponds; no, if you are using intermittent ponds. Mr. Emerick has been quite successful in adapting the mosquito minnow, *Gambusia affinis,* to living in the open oxidizing ponds at Calistoga, but it took a long period of patient work to adapt or acclimatize these fish to living in sewage polluted water, especially in the first pond, where the water is practically devoid of oxygen. But if a pond is allowed to dry out you will lose the fish. If there is any possibility of a change in operators at the plant, I would not depend too much upon fish as a mosquito control measure.

MR. BOWLUS: In disposing of sewage effluents by irrigation, is there a mosquito problem?

MR. GRAY: It depends upon what kind of ground you are applying the sewage to, and the type of crop.

MR. BOWLUS: Alfalfa fields, for example.

MR. GRAY: The state dairy inspectors may object to that, if the alfalfa is used for dairy cattle. The same objection will probably be made to sewage effluents on ladino clover. If the effluent is chlorinated, this objection might be removed. On other field crops, effluents can be used for irrigation, except for vegetables eaten raw, such as lettuce. Does any one know where such effluents are being used on crops?

MR. RAMSEIER: Concerning Psychoda flies in high-rate filters, it has been my observation that if the filter is built properly, the rock surfaces will be kept washed off and the flies kept down fairly well. But in some of the filters the specifications have not been complied with, and small rock down to pea gravel size has been used, so that the water can't get through fast enough to meet the design standards. In such cases you may find spots in the filters where there are more fly larvae than rock. In some places they have been able to abate the fly nuisance by spraying with kerosene, or similar materials. At others they put on a heavy dose of chlorine several times a day, holding the distributor arm and walking around slowly with it so that an especially heavy dose is applied. But you are working against yourself doing that. All such measures are merely palliatives, but they do help to keep down the flies.

MR. RAMSEIER: That is one of the purposes of high-rate filters, rate filters to keep washing the slimes through the filters?

MR. RAMSEIER: That is one of the purposes of high-rate filters, to produce a steady unloading of the slimes, but if the rock is too small, the flow over the surfaces becomes slow, as there isn't enough room for rock, slimes, flies and sewage. As a result the filters clog, and you get ponding. One operator told me that when he got a high rate of flow into his plant he couldn't see the stone on the filters.

QUESTION: Was the chlorine previously referred to applied at a nominal dose all the time, or was it something resorted to because the filter was ponding?

MR. RAMSEIER: It was applied merely as a means of keeping down the filter flies, to keep the place from being a nuisance. The operator was doing a good job on the flies, but he wasn't getting a good treatment job out of his filter.

MR. HARMON: We used to pond the standard-rate filters to control the flies, but on the high-rate filters ponding only makes the flies worse. I understand most of the high-rate filters cannot be back-flooded to drown out the flies.

A GENTLEMAN: In filters where you can look into the underdrains you will see a slime layer in the effluent troughs, and in one case I saw about a two-inch thickness of fly larvae unloading in the underdrains. If you dig down into the filter rock you will find slimes all through it.

A GENTLEMAN: I believe that if the bottom channels in the filters were built with a steeper pitch, instead of being so flat, you would have less trouble with flies.

MR. RAMSEIER: Undoubtedly many of the fly larvae are found in the filter underdrains, and are on the slimes in the collector channels, from whence they come out with the effluent in great amounts.

MR. BAUGH: I would like to ask whether a heavy intermittent application of chlorine could be supplemented by a continual moderate dosage of chlorine to keep down the biological life on the rocks? Has this been tried?

MR. RAMSEIER: At the plant mentioned a fairly heavy dosage of chlorine has been applied continuously, keeping down the flies but reducing the filter efficiency.

MR. GRAY: I would like to make a suggestion as to a material which may be useful in controlling filter flies. This is an aliphatic thiocyanate sold under the trade name of "Lethane." It is a well-known insecticide, somewhat similar to pyrethrum extract in its usefulness, but a bit more potent. It does not rapidly lose its toxicity in water as pyrethrum does. It can be used in an emulsion with kerosene and soap, and may avoid the difficulty we have with chlorine, that it may not stop the biological activity of the surface slimes, which are the active oxidizing mechanisms in rock filters. I would like to see some one try out this material on a practical scale. It looks promising.

MR. BAUGH: There is another insecticide, rotenone, obtained from a South American root, which might be used.

MR. GRAY: Rotenone is a possibility, as is also pyrethrum, but both at present are comparatively expensive. All of these materials are increasing in price, and what will be used will depend on toxicity to fly larvae, and relative cost, with a minimum interference with the oxidizing efficiency of the filter.

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By **W. H. WISELY,** *Secretary*

You will be interested to know that your Federation is still making progress despite the war, although some changes in activities have, of course, become necessary. An organization such as the Federation must adapt itself to the current needs of its members and you may be sure that all of our as yet limited resources are being directed into channels through which a maximum of service can be rendered.

The business management of the organization and Sewage Works Journal is proceeding satisfactorily and most of the problems incident to the reorganization in 1941 have been solved. You will appreciate that, with the present part-time supervision and limited office personnel, we are sometimes unable to avoid errors in handling Journal subscriptions and similar details, but we are making every effort to handle such matters promptly and properly. If at any time you experience difficulty in your contacts with the Secretary's office, we ask your forbearance and assure you that we are doing the best we can.

We have been reasonably successful in restoring the Journal to its intended publication schedule and we hope that you will agree that Editor Mohlman is maintaining the high standard of its editorial content. Your Secretary is trying to develop the plant operation section to be of greatest value and interest to those engaged in that work and will welcome your frank criticisms and constructive suggestions. I am particularly grateful for the cooperation which has been extended by members of the California Sewage Works Association in submitting material for the Operators' Corner because this has assisted greatly in affording a wide variety of material. I sincerely hope that your fine cooperation will continue because similar participation by all of our operator members is essential to the presentation of the kind of data and information you will find useful.

With the reorganization of the Federation taking place in January, 1941, it was hardly possible for any of our committees to produce tangible results before the Annual Meeting in New York. This year, however, your committees are making good progress, although their efforts are being directed along lines which take cognizance of present-day problems. I can confidently state that several of our committees will be able to submit reports of interest to you by the time of the Annual Meeting next October.

You will be interested to know that our membership is holding up very well despite the increase in dues, which was required to put the Federation

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FEDERATION AFFAIRS

(Continued from Page 57)

on a financially independent basis. Our total of individual members for 1941 was 2896 and our 1942 membership has passed the 2000 mark during this month. Past experience indicates that many members are somewhat late in transmitting dues and we anticipate a total membership for this year of about 2500. It is interesting to note that the Active Membership which includes a subscription to only alternate issues of Sewage Works Journal is finding little favor since we have only 39 such members to date.

From a financial standpoint, your Federation is also making satisfactory progress. You will recall that the Board of Control favored a conservative budget at the time of the reorganization last year and a similar budget to govern our current operations, consequently, a modest "back log" is being built up for insurance against a possible bad year or two in the uncertain future.

It is realized that there are many obstacles, in these times, in the way of traveling. If you can arrange, however, to attend the Federation's Third Annual Convention at Cleveland next October 15-17, I am sure that you will find it to be well worth your time and effort. The program will be devoted, in large measure, to war-time problems and it is hoped that everyone who can possibly arrange to attend, will do so.

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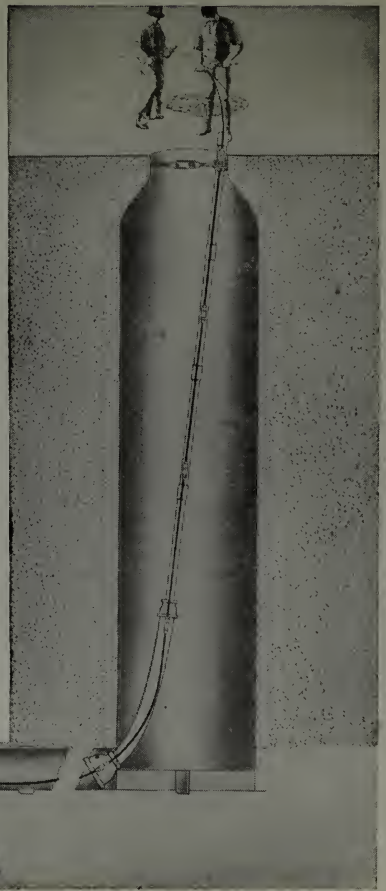

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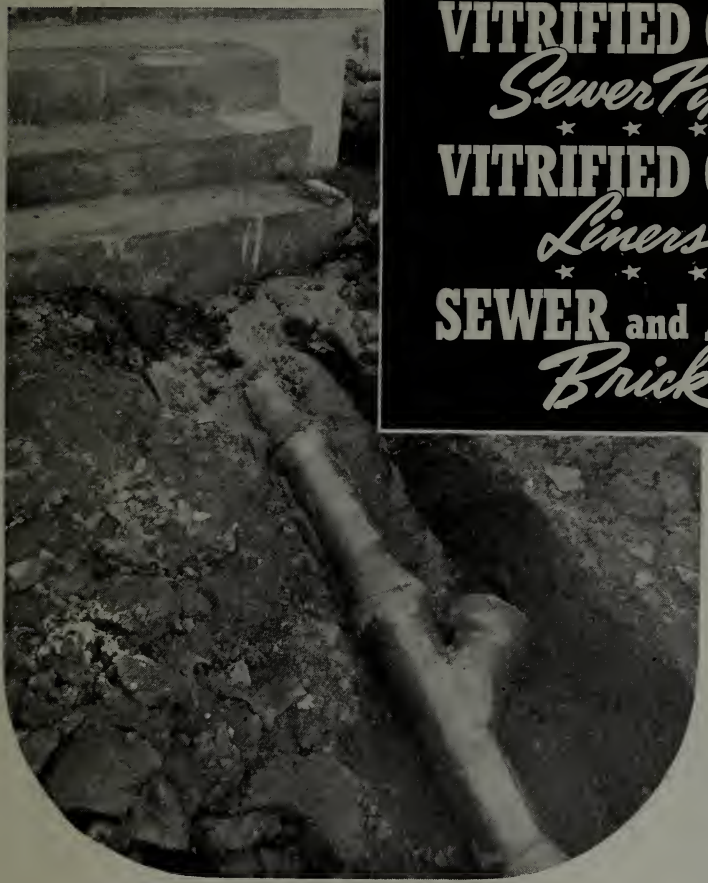

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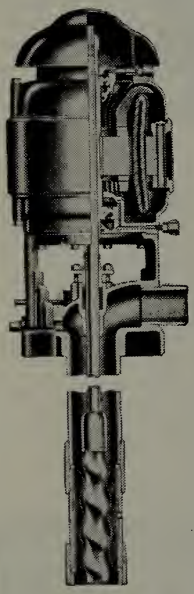

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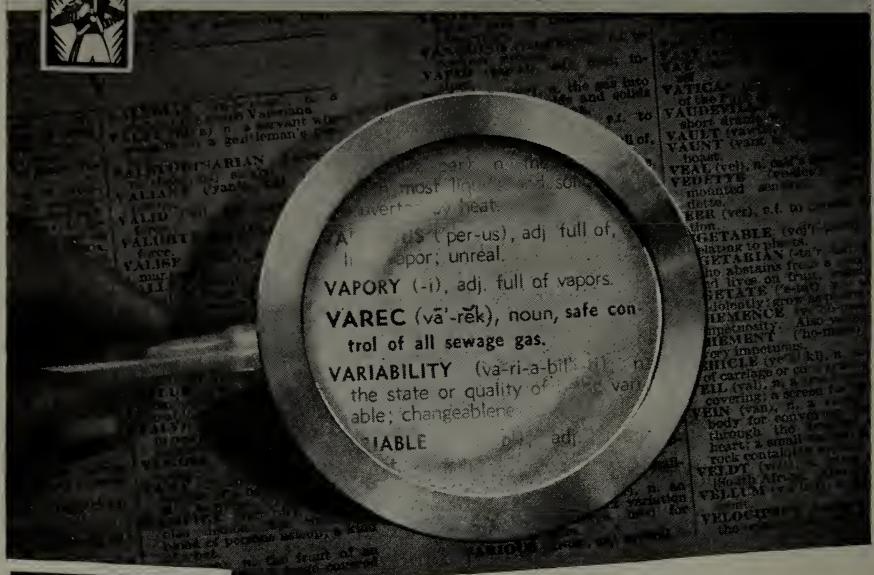

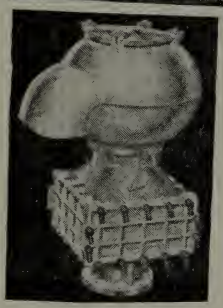

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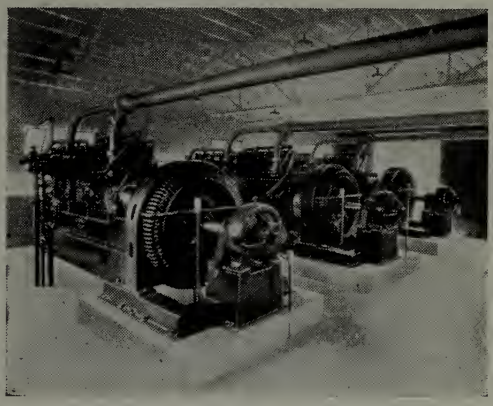

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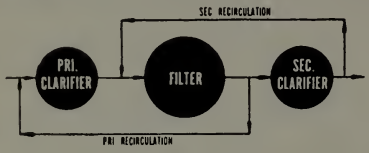
Some Preferred Biofiltration Flowsheets



SINGLE STAGE

TWO STAGE A

TWO STAGE B

Some Typical Operating Data

	Single Stage	Two Stage—A	Two Stage—B
Flow—Percent Design	62	100	64
Overflow Rates—Gals/Sq. ft./Day			
Primary Clarifier	460	730	655
Secondary Clarifier	440	920	760
Recirculations			
Primary Ratio	1.00	1.26	2.31
Secondary Ratio	0.93	0 44	2.86
Suspended Solids			
Raw—P.P.M.	217	221	279
Final—P.P.M.	9	24	19
Removal—Percent	95.9*	89.1	93.2
B.O.D.'s			
Raw—P.P.M.	258	209	327
Final—P.P.M.	9	27	31
Removal—Percent	96.5*	87	90.5
Duration Tests	3 mos.	8 mos.	2½ weeks

*Single stage removals high compared with two stage account of relatively lower clarifier overflow rates.

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The Biofiltration System comprises one or more combinations of Clarifiers and Filters wherein the unthickened filter discharge is recycled back to the Clarifiers. Single or two stage systems may be employed to give results comparable with (1) Standard Trickling Filters (2) Chemical Precipitation or (3) Activated Sludge. ∿ ∿ The Biofiltration System (a) gives a uniform effluent with fluctuating feeds (b) permits filter loadings up to 10 times normal, with 3 foot media depths and (c) costs 25-50 percent less to operate than Standard Trickling Filters or the Activated Sludge Process.

★ First, the Defense, now the War Effort have brought broad recognition to the Biofiltration System, an improved method of trickling filter treatment announced late in 1939.

More than 100 units are in use or under construction in 33 of the 48 states. Most of these are on the War Front, at army camps, naval bases, airfields and ordnance plants. Design populations range from 200 to 65,000.

The three flowsheets on this page have emerged as the best from among the dozen or more investigated or tested. Almost half the installations to date are of these three types.

● Write for a copy of our bulletin on "The Biofiltration System"—24 page illustrated booklet containing photos, layouts, cost and operating data and practical design information.

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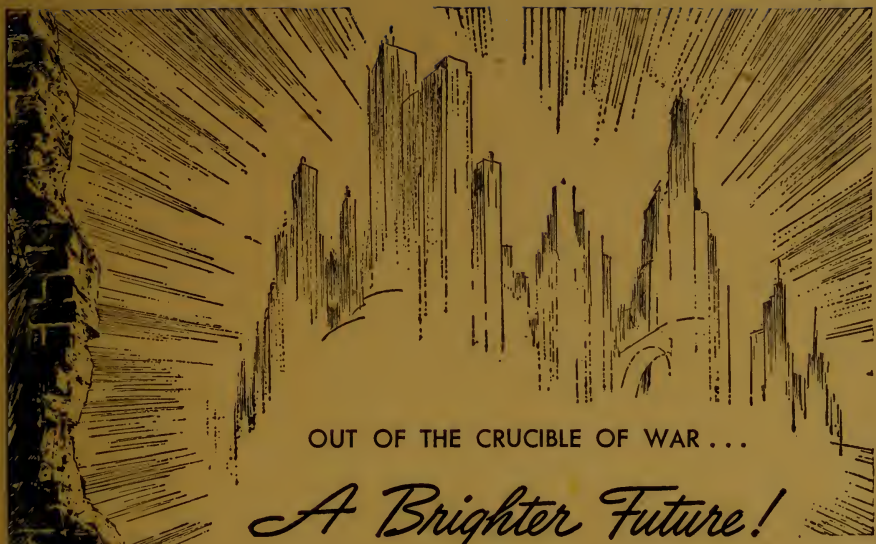

OUT OF THE CRUCIBLE OF WAR . . .

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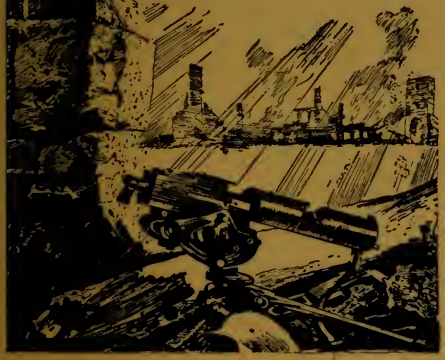

THE WAR has been a mighty stimulus to production. But it has been no less an incentive to research, enterprise and initiative in seeking out new products, new methods, new ways to shorten the road to victory. And herein lies the promise of achievement which, when the war is won, can make the future American way of life bright indeed!

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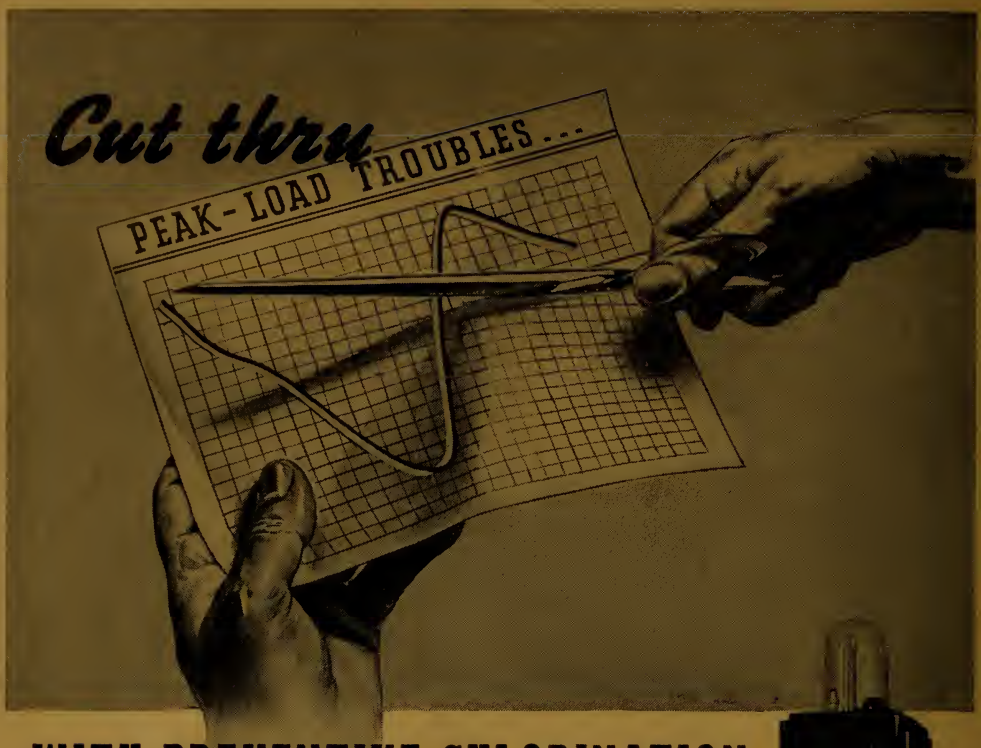

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